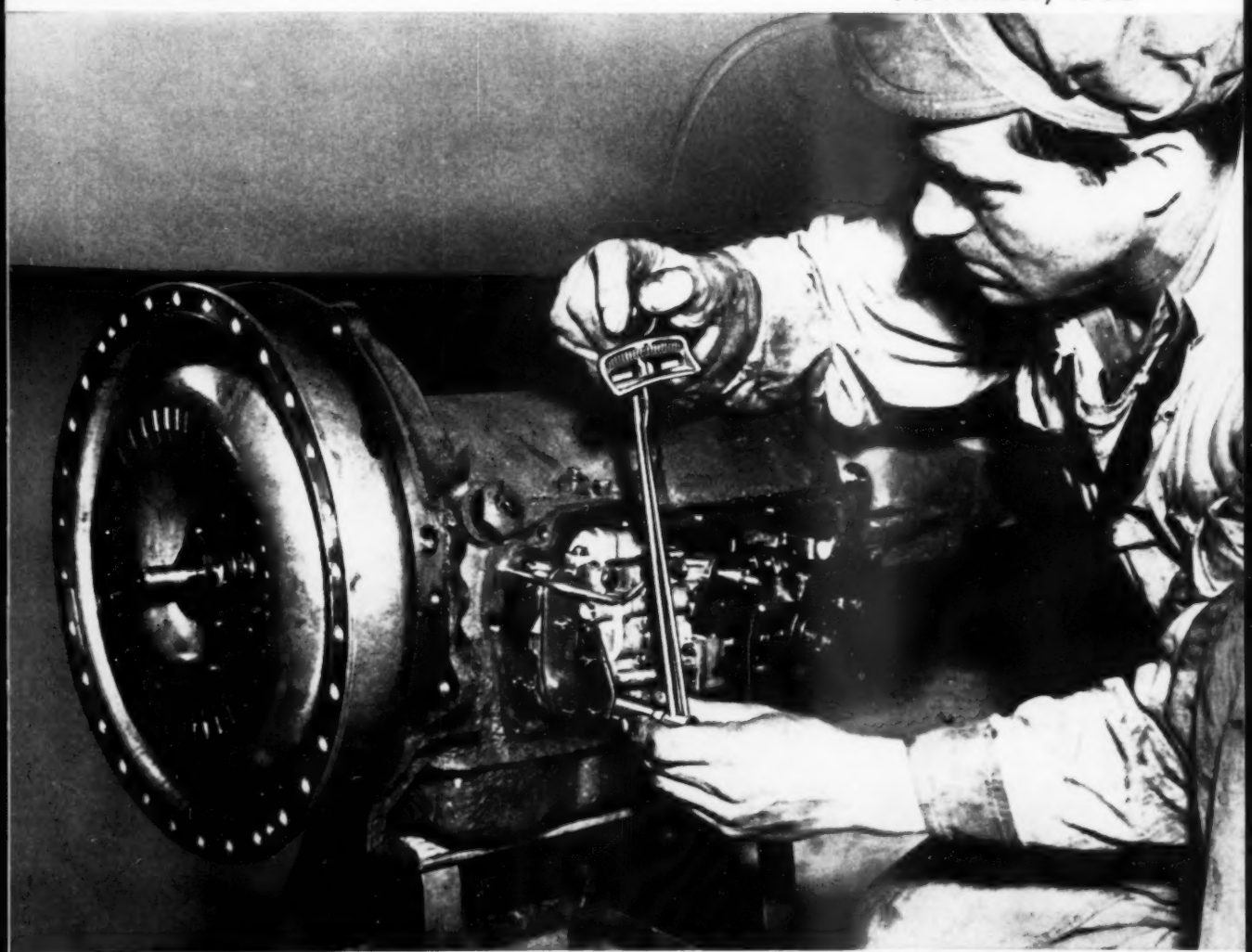
Automotive Service Digest

Our 46th year

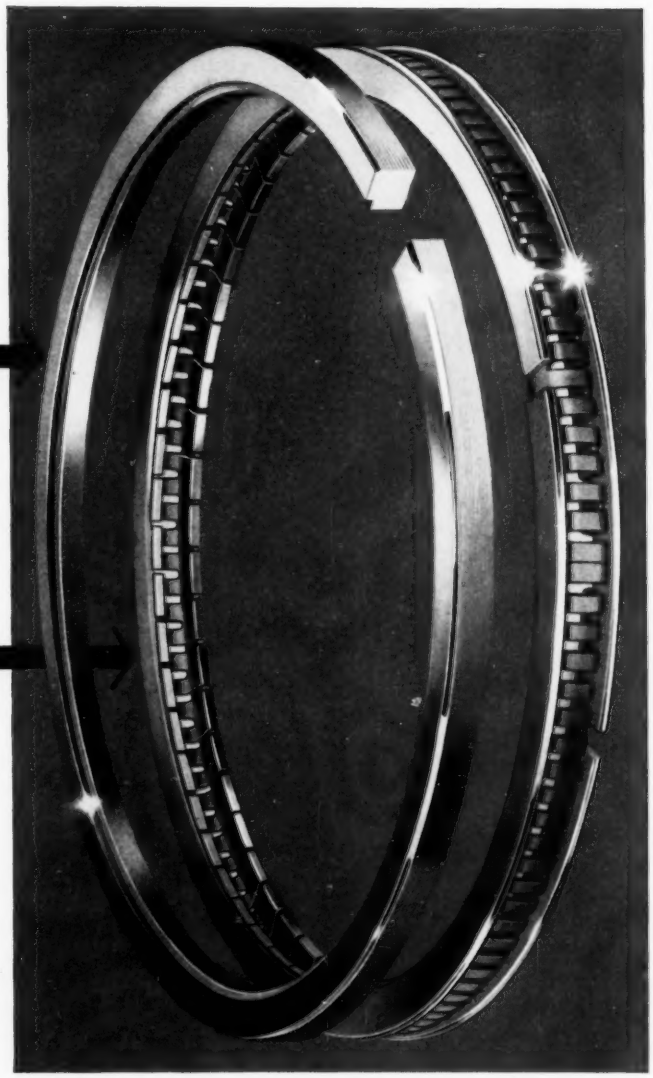
November, 1958



The truth about torque—See Page 12.

Why 2-in-1 chrome rings mean double life for pistons, cylinders, rings!

Perfect Circle engineering and research make possible 2-in-1 sets tailored for top performance in each make and model engine



TOP CHROME COMPRESSION RING

is specially designed to perform where pressures are greatest, heat highest, lubrication poorest. Special face finish assures quick seating to eliminate tedious break-in and assure customer satisfaction. For top performance characteristics are modified depending on make and model of engine.

TYPE "98" CHROME OIL RING

is designed to provide positive oil control for today's high compression engines. Self expanding spacer assures uniform pressure against cylinder wall, plus side-sealing action on ring groove. Some 2-in-1 sets contain the famous Chrome Oil Stopper oil ring, others the "98" oil ring, depending on make and model of engine.

INSURE CUSTOMER SATISFACTION

When you do a valve or ring job, install Perfect Circle Valve Seals. They stop a type of oil loss that even the best piston rings can not control.

PERFECT CIRCLE

PISTON RINGS AND POWER SERVICE PRODUCTS

Hagerstown, Indiana

Don Mills, Ontario, Canada

WHATEVER YOU NEED IN SERVICE OILS AND FLUIDS ...A PERMATEX CHEMICAL PRODUCT DOES IT BEST

Permatex products provide you with a full line of the right chemicals for all the special maintenance services you perform. Solvents like Solvo-Rust . . . tune-up oils like Permatex Toon-Oyl . . . lubricants like Graphite Grease . . . Automatic Transmission Fluid. Every one of them was tailored to its task . . . made for the professional . . . at a profit to you. Keep all these fine Permatex products on hand: PENETRATING OIL . . . PERMATEX TOON-OYL . . . SOLVO-RUST . . . ANTI-SEIZE COMPOUND (GRAPHITE GREASE) . . . HYDRAULIC JACK OIL . . . HEAVY-DUTY BRAKE FLUID . . . AUTOMATIC TRANSMISSION FLUID.

Send for your copy of the Permatex Catalog . . . which tells you how and where to use every member of this famous automotive chemical family. Ask your jobber or write us. Order the Permatex products you need!

PERMATEX

PERMATEX

COMPANY, INCORPORATED

300 Broadway, Huntington Station, L. I., New York

Factories: Brooklyn, N. Y. • Kansas City, Kansas

"There's a Permatex product for every maintenance need"

SEALING COMPOUNDS • POLISHES AND CLEANERS • SERVICE OILS AND FLUIDS • HYDRAULIC FLUIDS • SERVICE AND REPAIR PRODUCTS

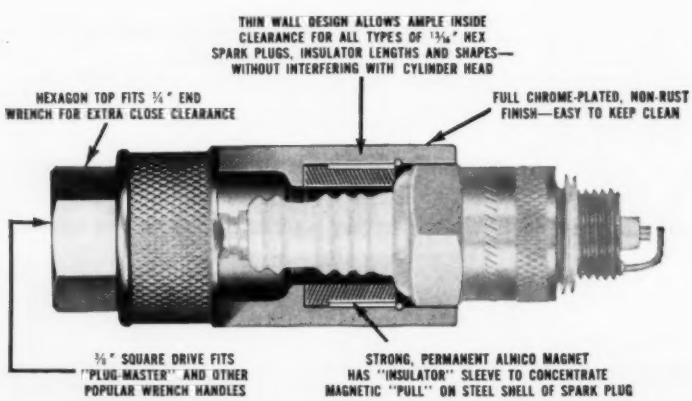
It's the new "Plug-Mate" for "Plug-Master"

Now — Champion introduces a with a firm, careful grip for faster,

Magnetic plug-holding makes plug work quicker and easier— and you get it only from Champion! And Champion's new time-and-trouble saving "Plug-Mate" has a low introductory price of only $1.49* with a special assortment of 30 fastest-moving Champion Spark Plugs!

Even if your hands are oily or greasy, you don't have any trouble handling the "Plug-Mate" socket. Your fingers always get a sure, no-slip grip on the band of diamond-pattern knurling that only Champion offers.

The "Plug-Mate" greatly reduces danger of breaking an insulator. Its deep 13/16" hexagon-fit fully covers hex of a spark plug shell, holds plug straight, without "cocking" that leads to insulator breakage.


THIN WALL DESIGN ALLOWS AMPLE INSIDE CLEARANCE FOR ALL TYPES OF 13/16" HEX SPARK PLUGS, INSULATOR LENGTHS AND SHAPES— WITHOUT INTERFERING WITH CYLINDER HEAD
HEXAGON TOP FITS ¾" END WRENCH FOR EXTRA CLOSE CLEARANCE
FULL CHROME-PLATED, NON-RUST FINISH—EASY TO KEEP CLEAN
⅜" SQUARE DRIVE FITS "PLUG-MASTER" AND OTHER POPULAR WRENCH HANDLES
STRONG, PERMANENT ALNICO MAGNET HAS "INSULATOR" SLEEVE TO CONCENTRATE MAGNETIC "PULL" ON STEEL SHELL OF SPARK PLUG

Selling and servicing spark plugs has always been profitable. And now Champion makes it faster and easier than ever! Champion's "Plug-Master" wrench is already the best tool available for removing and installing plugs. Now Champion's new "Plug - Mate" magnetic socket, holding plugs in a firm careful grip, makes your plug jobs go still faster and easier. (And that means more profitably, too!) Order "Plug-Mate" magnetic sockets for all your plug wrenches. And if your wrenches *aren't* "Plug - Masters" — order those, too. Next time your Champion supplier calls!

CHAMPION SPARK

and other spark plug wrenches . . .

magnetic socket that holds plugs easier removal and installation !

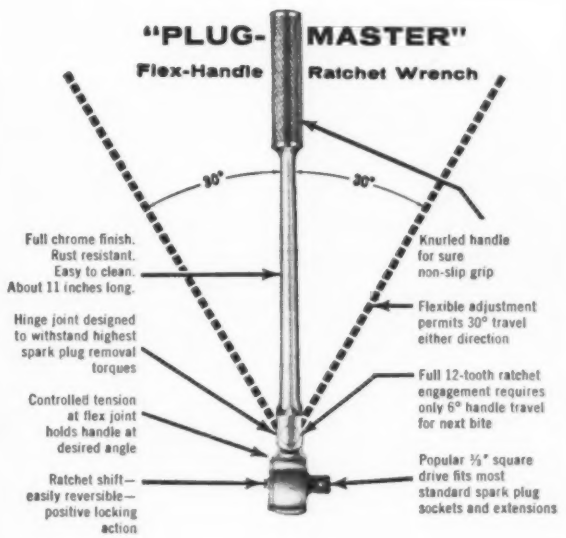
Even when held like this the "Plug-Mate" doesn't let a plug fall out, thanks to its strong, permanent Alnico magnet. Magnetic grip makes plug removal and installation easier and faster, yet doesn't magnetize plug.

AVAILABLE WITH SPECIAL CHAMPION ASSORTMENT

The "Plug-Mate" magnetic socket, packed in a 30-plug assortment of fastest-moving Champion types to save on separate handling and delivery costs, has a low introductory price of only $1.49.* This assortment —DRS-30—contains 10 F-14Y Champions, 10 J-12Y Champions and 10 J-18Y Champions.

**Suggested dealer price for socket only. Assortment of 30 Champion spark plugs at regular dealer price. (Minimum dealer price established by Fair Trade Agreement in Fair Trade States.)*

The Plug-Master Story


"PLUG-MASTER"
Flex-Handle Ratchet Wrench
30°
30°
Full chrome finish. Rust resistant. Easy to clean. About 11 inches long.
Knurled handle for sure non-slip grip
Flexible adjustment permits 30° travel either direction
Hinge joint designed to withstand highest spark plug removal torques
Full 12-tooth ratchet engagement requires only 6° handle travel for next bite
Controlled tension at flex joint holds handle at desired angle
Popular ⅜" square drive fits most standard spark plug sockets and extensions
Ratchet shift—easily reversible—positive locking action

Now acclaimed by mechanics everywhere as the outstanding wrench of its type, the "Plug-Master" is available from your wholesaler in your choice of four assortments of 50 fast-moving Champion plug types. (One for the over-all car market, others specifically selected for Ford Motor Company, General Motors, or Chrysler Corporation cars.) Packaging in these assortments enables you to obtain this new wrench at the low price of $4.25.*

*Suggested dealer price for wrench only. Assortment of 50 Champion plugs at regular dealer price. (Minimum dealer price established by Fair Trade Agreements in Fair Trade States.)

Dependable 5-rib

CHAMPION

SPARK PLUGS

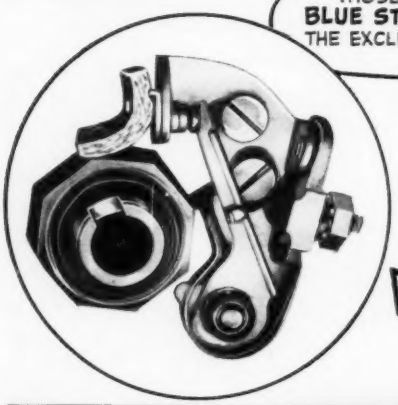
PLUG COMPANY • TOLEDO 1, OHIO

ANOTHER BLUE STREAK SECRET SERVICE TIP FOR YOU.

SHERLOCK McKANICK and MIKE

"The Case of the AMAZING CAM LUBRICATOR"

HEY, SHERLOCK, WHAT'S THIS PIECE OF FELT ON THIS BLUE STREAK POINT SET?



THOSE, MIKE, ARE THE NEW BLUE STREAK LUBRIPOINTS WITH THE EXCLUSIVE LUBRIWIK. IT APPLIES A CONTROLLED AMOUNT OF LUBRICANT TO THE DISTRIBUTOR CAM CONTINUOUSLY!

YOU MEAN...?

YES, MIKE. YOU JUST INSTALL "LUBRIPOINTS" AND FORGET THEM. THEY LAST LONGER BECAUSE THEY PRACTICALLY END RUBBING BLOCK WEAR.

THAT FELT WICK...?

CORRECT, MICHAEL! THE "LUBRIWIK" NOW ON ALL BLUE STREAK PRE-ASSEMBLED POINT SETS HOLDS ENOUGH LUBRICANT TO LAST FOR THE NORMAL LIFE OF THE CONTACTS

WOW! WE'LL HAVE MORE SATISFIED CUSTOMERS NOW WITH BLUE STREAK "LUBRIPOINTS"!

DEALERS: LUBRIPOINTS ARE AVAILABLE FOR ALL POPULAR CARS FOR MANY YEARS BACK. SEE YOUR JOBBER OR WRITE:
STANDARD MOTOR PRODUCTS, INC.
37-18 NORTHERN BLVD.,
LONG ISLAND CITY 1, N.Y.

LOVELY NIGHT, ISN'T IT?

YOU SAID IT!

NO WONDER 42,000 DEALERS SAY, "BLUE STREAK IGNITION IS BETTER FOR YOUR BUSINESS!"

WORLD'S FOREMOST HEAVY-DUTY IGNITION LINE

BLUE STREAK

REGULATORS • SWITCHES • COILS • CONDENSERS • WIRE AND CABLE • CONTACT POINTS

VOLUME XXXXVI

No. 562

November 1958

Cover

Units function no better than their fastenings . . . be they cylinder heads, bearing caps, transmissions or other essential elements. Torque tightening to factory specifications is a prime requisite of automotive service craftsmanship.

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For November

• Been complaints about some of the new engines using a lot of oil. Holds true, of course, for older engines that have done yeoman duty for thousands of miles. What to do about it? . . . We're breaking down the problem and coming up with solutions for restoring normal consumption. It's something that concerns every shopman and the article will be worth taking time to digest thoroughly.

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Published monthly by Automotive Service Digest, a division of National Market Reports, at 900 So. Wabash Ave., Chicago 5, Ill. Canadian affiliate: National Automotive Publishers, Ltd., Toronto, Ontario.

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BUSINESS OFFICE
900 South Wabash Ave., Chicago 5, HA 7-3464
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Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Jumps Out of Gear

Our shop's '52 Chevrolet, ½-ton pickup truck jumps out of high gear. I overhauled it, replacing all parts that showed wear, including cluster shaft, bearings, synchromesh unit and pilot bearing.

Since rebuilding the unit, it's just as bad, if not worse. I can drive it for 100 to 200 miles without it jumping out; then on a good smooth road it jumps out from eight to a dozen times within a space of twenty miles. What can you advise?—*R.K., Grand Rapids, Mich.*

Answer: The usual reason that a manual transmission jumps out of gear is that there is wear in the thrust bearing or thrust washer on the end of either the cluster gear or the main transmission shaft. This allows a little end play and with the reversal of torque that takes place with the acceleration and deceleration that is continually taking place as a car or truck is driven on the highway, the end play will allow gradual disengagement.

About all that can be done to correct this trouble is to replace the worn parts and be very certain that end play is limited to the amount allowed in the original assembly.

A Question of "Has to Do"

I am in a bad situation here in Bangkok about proper part numbers for replacing regulators on equipment in our shop. For example, the output of the generator on some of our rolling stock is 45 amps, whereas the regulator obtainable is only 32-37 amps for the maximum current regulator setting.

In such a case, what will happen to the charging circuit if I use this under-capacity regulator with the 45 amp generator? Also, what allowances should I make in the settings of the cut out, voltage regulator and current regulator?—*V. V., Bangkok, Thailand.*

Answer: If the only regulator you can get has an ampere capacity of 32-37 amperes, you should be able to use it satisfactorily, unless there are heavy drains on the battery. Actually, the only time the full capacity of the current regulator is used is after excessive battery discharge is required, as when difficulty is encountered in starting the engine. If the conditions of use are such that the battery will not stay charged with this regulator, you will have to charge the battery from time to time.

As to the regulator settings; set in the usual way to give a voltage of approximately 7.4 on 6 volt systems or 14.8 on 12 volt systems, after the generator is thoroughly warm, and with the battery charged to 1.260 or more. Set the current regulator at the maximum specified setting.

Won't Stay "Timed"

Every time we time a customer's '57 Plymouth V-8 it will only stay timed for a short time . . . and, I might add, it is giving us one h - - - of a time!

After timing the engine, it runs fine for a few days . . . then when the ignition is turned on the starting motor kicks back and locks.

Before we go any further on this job, can you suggest something we might be overlooking in our timing procedure? *M. I., Allen, Ky.*

Answer: Obviously, something is taking place to change the ignition timing; possibly a stripped distributor set-screw, which allows the screw to work loose . . . or it may be that the screw is being tightened so tight that it stretches slightly. Be sure that a lock washer is used under the head of the screw. It is also possible that either the spring in the vacuum advance device or the automatic advance device may be sticking.

We would suggest that first you put the distributor on a tester to check the advance, and to be sure there are no leaks in the vacuum advance line. Also be certain that the breaker points are properly tightened; if not, the dwell and the ignition timing will change.

Hard Starting

A customer's 1955 Plymouth Six (standard transmission) is giving our shop some headaches.

The car will start after standing overnight, run for five or ten seconds, and then die out as though out of gas.

The first time this happened, I removed the air cleaner and worked the accelerator linkage while peering down into the carburetor... No gas! Pouring gas into the carburetor, or hand choking the engine, however, gets things into motion, and the engine will run fine for the rest of the day. But after standing overnight again it's the same old story—the engine starts, runs a few seconds, and then stops.

I rebuilt the carburetor and automatic choke, and checked the fuel pump (pressure and vacuum were up to specs) but still the trouble persisted. I then did a complete tune-up and installed a new carburetor and fuel pump—even removed the gas tank and cleaned it and all lines. That seemed to do the trick; the car started and acted like normal again.

3,000 miles later it is back in my shop, acting the very same way that it did before. Before I go any further, can you please give me some suggestions as to what to look for?—*H.H., Erlton, N.J.*

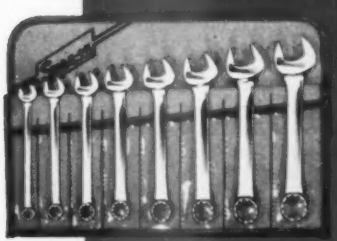
Answer: Since the trouble appears to be in the fuel system, check the fuel pump for delivery (should be approximately 1 pint in forty seconds). If fuel delivery is OK, let the car stand overnight and then remove the air cleaner and the top of the carburetor and see where the fuel level is in

(Continued on page 70)

WHEN CHANGING YOUR ADDRESS

Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept., Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**

Give Your Hands a Break



GET NEW Snap-on COMBINATION WRENCHES NOW

One pair to a customer — you can't trade those hands in on new ones. Give 'em a break. Start fresh with the tools you use most — like a new set of *Snap-on* Combination wrenches. Many top-notchers rate them the handiest tools they own.

Smooth, rounded handle lets you apply real pressure — no sharp edges to bite in. Accurately machined openings fit nuts securely — help prevent slipping — protect knuckles from cuts, burns and bruises.

Good tools in good hands save time, boost income. Get a new set of combination wrenches the next time your *Snap-on* man calls.

To Mechanics Who Service Foreign Cars

Ask about *Snap-on* wrenches in Metric or Whitworth standard sizes. Available in most popular types and sizes.

Look at all these advantages

1. Long handles for extra leverage, short handles for tight quarters, midget series for tiny jobs — in a wide range of sizes and sets.
2. Boxocket® head is hot-broached to give clean, strong wrench walls.
3. Chamfered edge slips onto nut quickly.
4. Accurately centered box opening gives walls of equal strength and thickness.
5. Open end is set at 15-degree angle — turns nut with 30-degree handle movement.
6. Boxocket is offset 15 degrees to allow knuckle clearance over obstructions.
7. Slim heads and pear-shaped jaws slip into tight spots.
8. Rounded, open-end bottom helps prevent breakage.
9. Beautiful chrome finish protects wrench against rust.

SNAP-ON TOOLS
CORPORATION
8018-K 28th Avenue • Kenosha, Wisconsin

BY HERB CARRIER
Detroit Editor

Spokes from the "hub"

Gold plated wrenches! That's right, implements for turning nuts and bolts, and skinning knuckles, are now being plated with gold. Special seven-piece sets of combination box and open-end wrenches have been given a 20 karat gold finish by the Herbrand Tool Company, Fremont, Ohio.

Says R. D. Black, advertising manager of the Herbrand Division: "We made up a limited number of these gold plated wrenches to commemorate our tenth anniversary as official and exclusive tool supplier for the Indianapolis Speedway. We were pleasantly surprised when orders for the tools flooded in from working mechanics all across the country.

"Naturally, we'll fill the orders as soon as possible. They're excellent working tools, not just display items, and the cost per set runs only a few dollars more than our 'Hex-Fit' wrenches, which are finished in bright chrome."

We're all for "elevating the mechanic," "dignifying the trade," and "upgrading the technician," but *gold plated wrenches*!! What next?

* * *

Permanent doesn't mean forever—at least not when the term is applied to the use of ethylene glycol, the so-called permanent antifreeze.

A recent survey by the Chemical Specialties Manufacturers Association, indicates that one out of every five cars on the road today has a leaky radiator because used antifreeze (permanent) isn't drained and discarded each spring.

According to the antifreeze experts, the corrosion inhibitors tend to break down after a year's use. Trying to add inhibitors to extend the normal life of the antifreeze isn't easy. The base material of the used antifreeze differs considerably from that of new. Replenishing inhibitors is difficult because the chemical structure has actually changed in proportion to severity of use.

Changing permanent antifreeze yearly is not a new theory. It is, however, a tough idea to get across to some tight-fisted car owners. The above arguments may be just the ammunition necessary to persuade your customers to install new permanent antifreeze each year.

* * *

A peek at pay scales. Among mechanics, as among all other groups who work for a living, paycheck figures come in for a lot of conversation. Strange, though how few mechanics actually know what other mechanics earn.

This is especially true in flat-rate shops. Common practice of 50-50 men is to groan at each price on the repair order, swear up and down they can't do the job for that kind of money, rave a while about the whole industry going to pot, then go to work and knock the job out in about one-quarter of the factory suggested time.

Obviously, come payday they don't broadcast the size of their paychecks. Good weeks mean good paychecks, slow weeks mean not-so-good paychecks. This is the risk of working 50-50.

For hourly-rated mechanics, it's a different story. They know exactly how much they'll get paid each payday. Even here, though, the rate per hour is not always open for publication.

Confused about where your paycheck stands in the scheme of things? Just for kicks, compare it to these figures: Members of Machinists Lodge 2171, employed as mechanics by a Jamestown, Pa., dealer, now receive $2.05 per hour. Fringe benefits include laundry, uniforms, paid vacations and holidays, and a 10% bonus for night shift work.

In Toledo, Ohio, the Toledo Automobile Dealers Association lists minimum pay scale for mechanics at $2.40 per hour for flat-rate men, and $2.45 per hour for hourly rated men.

* * *

State safety check figures, indicate that compulsory vehicle inspection can reduce the number of accidents by making sure cars are safe to operate. This, of course, is the object. An interesting side-note—particularly to mechanics and garage owners—is that the 1958 National Vehicle Safety-Check reveals one out of every five cars now in use needs some repairs to make it safe to drive. These figures don't include non-safety items like engine faults.

With 67 million vehicles on the road, there is apparently a whale of a lot of service work going begging.

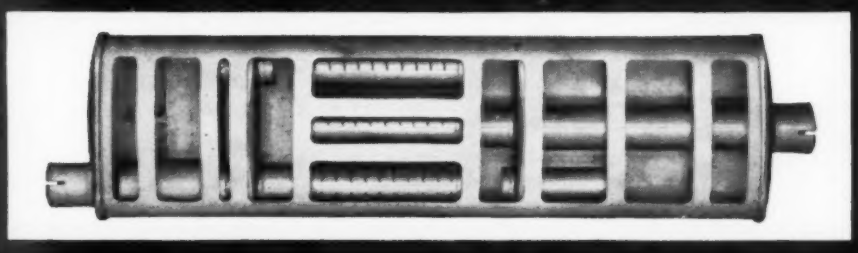
State safety checks can force owners of unsafe cars to have the necessary repairs made before they are permitted on the public roads. If *every* state had safety check laws, existing repair shops would be swamped with work. How much work? Well, for example, The West Virginia State Police Department recently released statistics which showed that costs per repairs, adjustments, and replacements on motor vehicles inspected in the state during the last fiscal year averaged $5.29 per car.

With a total of 604,370 vehicles inspected, the aggregate repair bill came to $3,149,145!! It's easy to see why organized groups of mechanics and garage owners favor compulsory inspections.

But the general car-owning public, even when it knows it will substantially reduce the tremendous annual accident rate, welcomes talk of compulsory vehicle inspection laws about as much as a sophisticated crowd of French poodles would welcome a visit from a strange mongrel with a cold nose.

NEW

MoPar PROFIT MAKER FOR YOU



New MoPar Sono 4X muffler

The *all-new* MoPar Sono 4X muffler engineered by Chrysler Corporation is ready to bring you *more profitable* service business—now!

The *new* MoPar Sono 4X gives you:

- **Higher profit** because it's Chrysler Corporation-engineered to *fit* the Chrysler-built cars you service—reduces installation time, gives you more time for additional service business.
- **Reduced inventory** by standardization—fewer mufflers now service most Chrysler-built cars.
- **Guaranteed performance**—works in perfect balance with other related parts, because it's engineered *especially* for Chrysler Corporation cars' exhaust systems.
- **Immediate availability** from your local MoPar Wholesaler or Chrysler Motors Corporation dealer. You also can get MoPar's new merchandising aids to help increase your muffler sales.

The *new* MoPar Sono 4X gives your customers:

- Up to 100% longer muffler life because it's zinc-coated both *inside* and *outside*.
- A muffler designed to reduce the four major causes of muffler failure: internal corrosion, vibration, internal temperature variations, backfire.
- Measurably quieter operation with an important reduction in back pressure.
- A muffler engineered for Chrysler Corporation-built cars—to *keep* new car performance.

The MoPar Sono 4X muffler is another example of the complete "bumper to bumper" profit makers designed for Plymouth, Dodge, De Soto, Chrysler and Imperial cars—available only from MoPar.

Sell the line that keeps your customers sold on you—MoPar

MoPar Division
Chrysler Motors Corporation
Detroit 31, Michigan

MoPar **PARTS AND ACCESSORIES**

These are TORQUE WRENCHES used and recommended by leading engine builders because they are:

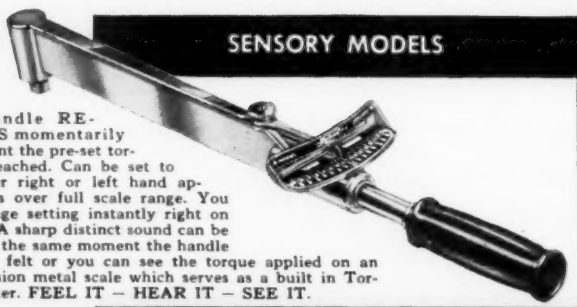
★ Accurate For Life

★ Faster and Handier to use

★ The only torque wrenches that can be used accurately with adapters and extensions

★ Guaranteed accurate within 2% of maximum scale reading

★ Ruggedly constructed for continous service



SENSORY MODELS

The handle RELEASES momentarily the instant the pre-set torque is reached. Can be set to signal for right or left hand applications over full scale range. You can change setting instantly right on the job. A sharp distinct sound can be heard at the same moment the handle signal is felt or you can see the torque applied on an Easy Vision metal scale which serves as a built in Torque Tester. FEEL IT – HEAR IT – SEE IT.

CATALOG NUMBER	CAPACITY INCH POUNDS	MECHANICS SUGGESTED NET PRICE
S300-I	0 to 300	$35.20
S600-I	0 to 600	36.90
S1200-I	0 to 1200	38.85
S1800-I	0 to 1800	47.95
S2400-I	0 to 2400	61.80
S3600-I	0 to 3600	82.30
	FOOT POUNDS	
S25	0 to 25	35.20
S50	0 to 50	36.90
S100	0 to 100	38.85
S150	0 to 150	47.95
S200	0 to 200	61.80
S300	0 to 300	82.30

STANDARD MODELS

The same as the Sensory model, but is not equipped with the signalling feature. A deluxe gauge tool that is guaranteed to remain accurate for life and is engineered to cycle a minimum 300,000 times.

CATALOG NUMBER	CAPACITY INCH POUNDS	MECHANICS SUGGESTED NET PRICE
F300-I	0 to 300	$24.30
F600-I	0 to 600	27.15
F1200-I	0 to 1200	29.95
F1800-I	0 to 1800	35.70
F2400-I	0 to 2400	53.95
F3600-I	0 to 3600	68.70
	FOOT POUNDS	
F25	0 to 25	24.30
F50	0 to 50	27.15
F100	0 to 100	29.95
F150	0 to 150	35.70
F200	0 to 200	53.95
F300	0 to 300	68.70

ROUND BEAM MODELS

A torque wrench designed and priced for the mechanic. Guaranteed life time accuracy. Each model in the wide range of torque capacities is light weight and compact in design. The torque accuracy is held to the highest standard 2% of the maximum scale reading. Patented handle allows using these with adapters and rugged construction makes them almost indestructible.

CATALOG NUMBER	CAPACITY INCH POUNDS	MECHANICS SUGGESTED NET PRICE
DR50-I	0 to 50	$17.95
DR100-I	0 to 100	17.95
DR200-I	0 to 200	17.95
DR300-I	0 to 300	17.95
R600-I	0 to 600	12.35
R1200-I	0 to 1200	13.15
R1800-I	0 to 1800	16.75
R2400-I	0 to 2400	17.95
	FOOT POUNDS	
DR25	0 to 25	17.95
R50	0 to 50	12.35
R100	0 to 100	13.15
R150	0 to 150	16.75
R200	0 to 200	17.95

SPRING TESTER

Permits fast and accurate matching and checking of valve springs, clutch springs, etc. Threaded column with vernier scale permits adjustment of test platform to exact test length within .003 of an inch. Built in tone signal device sounds the instant spring is compressed to desired length. Operated by any accurate torque wrench. Spring strength, in pounds, equals the foot-pound reading of the torque wrench.

Free TORQUE SPECIFICATIONS

For over 72 makes and more than 700 models of automobiles (U.S. and Foreign), trucks, tractors, outboards, motorcycles, diesel, aircraft, marine and small air-cooled engines. SPARK PLUG–WHEEL BEARING–VALVE SPRING DATA and many helpful torque tips . . . Plus handy torque chart for all screws –No. 4 to and including large 2 inch bolts. 31 pages of factory approved information. Sent Free if requested on your auto service letter or bill head. Please also write name of your local tool jobber.

PA Sturtevant CO.
ADDISON QUALITY ILLINOIS

World's Leading Exclusive Manufacturers of Torque Wrenches

Editor's page

The 500's shop lesson

● FIFTY-TWO ENGINES were Magnaflux- and Zyglo-inspected after the qualifying trials which preceded the running of this year's Indianapolis 500-mile race.

During that period, over 2000 individual pieces were tested, and 50 of them rejected because of fatigue cracks in highly stressed areas. Among the rejects were crankshafts, pistons, connecting rods, gears, steering arms, a universal joint, bearing support, front axle and a fuel line fitting.

Two things from the 1958 race preparations point emphatically to the benefits derived from inspection of car parts.

First: Of the 22 qualified cars there were only 3 in which engines and transmissions were not checked. The records have it that two of these cars dropped out of the race—one after 68 laps because of drive shaft troubles, the other after 80 laps, due to a gear failure.

Second: Nine of the first 10 cars to finish had had their engines and other parts inspected. Of these cars, 7 had shown defective parts which obviously, could have proved disastrous, had they been used.

So much for the Indianapolis 500 where everything is at stake for race car owners and their drivers—property and lives, let alone the winning of the race. Turning to our own, less dramatic perhaps, but fully as important field of automotive service, the inspection and checking of customers' cars warrants increasing attention.

Naturally, a car dealer's service department or the independent shopman is hardly in a position to duplicate the minute inspection routine followed at the Indianapolis 500.

But shops can take advantage of establishments in their vicinity—engine rebuilders, for example—who have non-destructive test equipment and can readily check highly-stressed parts before buttoning up a job.

True enough, grooming race cars is quite removed from the every-day operation of conventional motor vehicles. But from the standpoint of vastly more cars and trucks running faster and farther on modern highways, and in the interest of safety, more careful shop checking must become the order of the day.

It's one thing to do only the service work a customer orders, but what about the things that need fixing and are detected by even a casual glance or superficial test when the car is in the shop?

A diplomatic approach might be to attach to the customer's bill a note calling attention to service work that should be done immediately or in the near future. Calling attention to them verbally may not be effective. People have a way of forgetting. A listing would more likely stimulate favorable customer action.

Ben Ikert
EDITOR

AUTOMOTIVE TECH KNOW-HOW

By HERB CARRIER
Detroit Editor

The truth about torque

Every shopman knows "all about" torque . . . But how is it different from tension? Its application to nut and cap screw tightening definitely establishes "how tight is tight." But why? . . . And what is the role of extensions, adapters and attachments? Their effects on lever length must be compensated.

● TODAY'S AUTOMOTIVE ENGINEERING places an obligation of precision workmanship on the service mechanic. Gone are the days of tightening nuts and capscrews until they either stretched, squawked, or just snugged up. The torque wrench—and the ability to use it accurately—make up an indispensable combination in most every automotive repair and service situation. Elastic properties of metal make this so.

Few people realize it, but steel is more elastic than rubber. There are exceptions, of course, but in general steel will return to its original shape after being stretched many more times than will rubber. By definition, a material's ability to snap back to shape after being stretched determines its elasticity, not its ability to stretch.

In designing threaded fasteners, such as nuts and bolts, engineers take advantage of metal's elasticity in creating clamping forces which can securely hold one or more components together. Tightening a nut or bolt causes it to elongate or stretch. The tendency of the fastener to return to its original shape actually exerts the desired holding force, called tension.

There are limits, however, to which the metal can be stretched without permanently setting. When this happens, elasticity is lost and the metal will no longer return to its original shape. A bolt that has been stretched too far—beyond its elastic limit—is no longer suitable for use as a fastener.

HOOKE'S LAW

There is a law in physics which states the relation between the amount of distortion of elastic bodies and the force which distorts them. The law is named after Robert Hooke of England who first observed and measured the behavior of elastic materials. Hooke's Law states: *The distortion produced in elastic bodies is proportional to the distorting force.* This means that a certain force applied to a certain body will cause a certain amount of distortion. Double the force and the distortion is doubled. Triple the force and the distortion is tripled. Continual application of the distorting force would eventually cause the material to exceed its elastic limits. It would become permanently distorted, and would not return to its original shape after the force is removed.

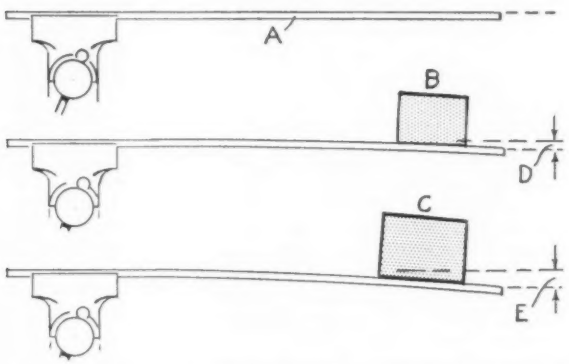
The various nuts, bolts, and screws used in fastening

Spark plugs always should be torqued to specifications. Improper tightening torque may cause stretched or cracked threads, distorted or closed spark gap, broken shell, compression loss, poor heat dissipation or other troubles.

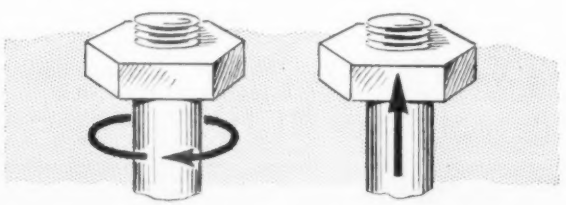
together the thousands of assemblies in modern automobiles are all carefully engineered to deliver top efficiency *when tightened to predescribed specifications.* Under-tightening will not permit the fastener to exert the clamping force necessary to hold the assembly together. Over-tightening will cause the fastener to exceed its elastic limits and become worthless as a clamping device. Either case can result in annoying squeaks and rattles, or serious mechanical failure. Uneven tightening of fasteners used to clamp large assemblies—cylinder heads to blocks, for example—can cause an actual warping, or distortion of the entire assembly, and any subassemblies that may be contained therein. There's no way around it, nuts and bolts must be tightened accurately, evenly, and to specifications.

TORQUE WRENCHES

The tool used to measure the amount of tightening force applied to a fastener (as every mechanic knows) is called a torque wrench. This tool is designed on the



According to Hooke's Law, pertaining to elastic bodies, the deflection of steel is proportional to its subjected load. That is, bar A, for example, with load B is deflected distance D. With load C (twice that of B), the bar is deflected the distance E, twice the distance D, and so on until the metal's elastic limit is reached.

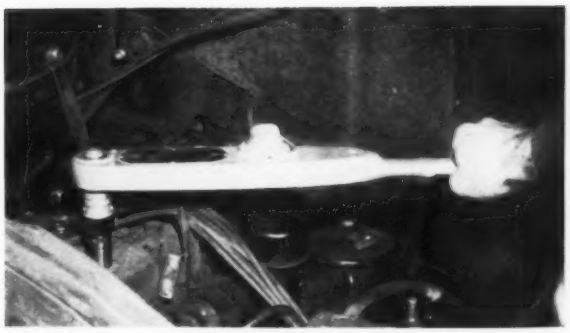


Illustrating the difference between torque (left) and tension (right). Torque is twist, the standard unit of measuring being foot-pounds. Tension is straight pull, measured in pounds.

fundamental law of the lever. In a nutshell this law is *force* times *distance* equals the *torque* about a point.

The term force, or pull, means the amount of force applied on the tool handle by the operator. Distance means the length of the lever measured between the centerline of the tool drive square and the centerline of the force being applied at the handle, as shown in one of the illustrations. In order to calculate the torque at the drive square of the tool it is only necessary to multiply the force times the distance.

The torque formula can be written as follows: Tw = F × L. Tw stands for torque, F for force, and L for lever length. Accuracy of this formula depends upon the length



A frequent and important torque wrench use is head bolt tightening. Non-uniform tightening or overtightening may cause loss of compression, increased wear, poor fuel economy and early engine failure.

of the lever being measured at 90° to the direction of the force. Violation of this rule will result in a false answer.

INCH-POUNDS OR FOOT-POUNDS

Very often torque specification tables call for inch-pounds for some fasteners, and foot-pounds for others. If the length of the torque wrench is measured in inches and the force applied to the wrench handle is measured in pounds, the torque developed will be inch-pounds. If the wrench length is measured in feet and the force applied to the wrench handle is measured in feet, the torque developed will be termed foot-pounds. Wrenches working with inch-ounces and inch-grams are also available.

Ordinarily, torque wrenches for automotive use are either scaled for inch-pounds or foot-pounds. In rare cases where it becomes necessary to convert from inch-pounds to foot-pounds, or vise-versa, it can be done by a simple mathematical process:

Foot-Pounds × 12 = Inch-Pounds

Inch-Pounds ÷ 12 = Foot-Pounds

This conversion is, obviously, based on the fact that there are twelve inches in a foot. It follows that twelve inch-pounds equals one foot-pound.

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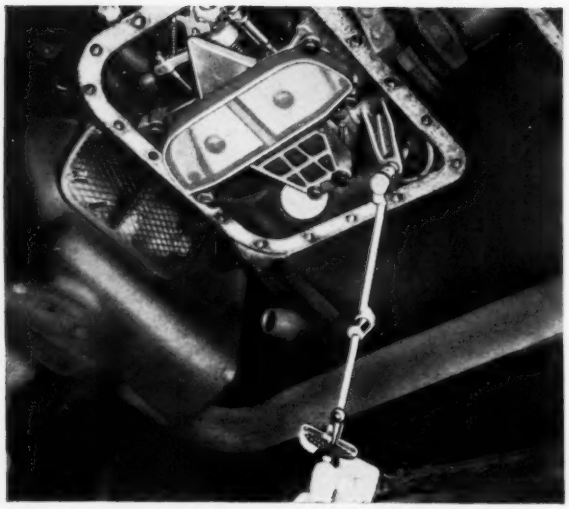
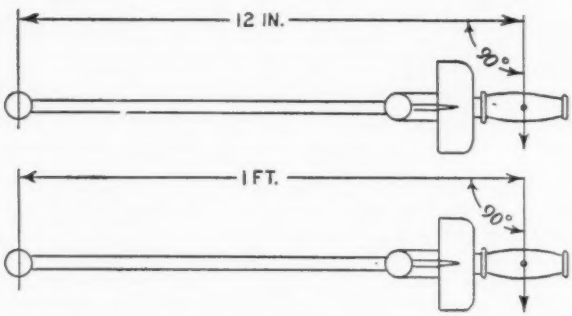
Even in under-car work, torquing to specifications on automatic transmissions is easily done. Here the mechanic is observing clear-view dial in obtaining pre-set reading.



A torque wrench extension, attachment, or adapter adds to the over-all lever length, and an erroneous torque reading might result unless compensated for mathematically, or by use of a sliding chart.

The Truth About Torque . . . CONTINUED

In general use today there are only two basic types of torque wrenches: *Rigid Frame* wrenches, and *Flexible Frame* wrenches. The measuring element in a rigid frame torque wrench is enclosed in a case. The measuring element of a flexible frame torque wrench is the wrench frame itself.



If the lever length is measured in inches and the force in pounds, developed torque is referred to in inch-pounds. If measured in feet and the force in pounds, developed torque is referred to as foot-pounds.

Rigid Frame Torque Wrenches: Early torque wrenches of this design operated hydraulically. As torque was applied to a fastener with this type wrench, a piston was actuated inside a fluid filled cylinder. As the force applied to the handle increased, the piston exerted more pressure on the oil within the cylinder. A hydraulic pressure gauge was tapped into the cylinder which was calibrated to enable the operator to determine the amount of torque he was applying.

Because piston movement was minute, a multiplication device was built into the hydraulic system to increase the movement of the gauge needle so that it could be easily observed. The hydraulic indicating apparatus of this type torque wrench was accurate but comparatively fragile. For this reason, the hydraulic torque wrench fell into disfavor due to the rough use it received in repair shops.

Another type of rigid frame torque wrench employs a torsion bar principle. The torsion bar is attached to the frame of the tool so that when torque is applied to a fastener the bar twists about its longitudinal axis. A rack on the end of the bar meshes with a pinion which actuates the pointer of a dial indicator. Through a favorable gear ratio even a slight movement of the bar is reflected in an easily visible movement of the dial indicator.

The torsion bar, the rack, and the pinion are all incased in the torque wrench frame which protects the moving parts from damage. With one make of wrench the operator adjusts the dial to the bolt tension required and the bolt is tightened until the pointer reaches zero or a bulb on the light indicator flashes.

The slender design of this wrench permits its use in close working quarters, and when used with a ratchet adapter, the wrench handles those jobs where handle movement is limited. The torsion bar type of rigid frame torque wrench provides a basically sound means of measuring torque.

There are several other types of rigid frame torque wrenches, from encased beam types to cam operated types, but little is to be gained by a detailed examination of each. The point to remember is that in the rigid type of wrench the frame remains fixed and the measuring element is enclosed in a metal case.

Flexible Beam Torque Wrenches: This type of torque wrench consists of a wrench head to which is attached the drive square, a measuring element (a round rod or a beam), and a pointer. The measuring element terminates in either a pivoted handle or a rigid handle. A dial attached to a rigid metal plate provides a means of reading the applied torque.

In operation, torque is developed in the tool head as force is applied to a fastener. The beam, or rod, measuring element flexes and changes relationship between the pointer and the dial. The amount of torque being applied is read on the dial and is indicated by the pointer.

The lack of frictionally moving parts and sensitive indicating devices makes this type of torque wrench highly suitable for use where a high degree of accuracy and rough duty use is important. The wrench's accuracy can be calibrated extremely close through use of a pivoted handle. The pivot point localizes the applied force to a specific spot rather than distributing it over the entire length of the handle.

Bearing cap nuts must be torqued for maximum bearing life and overall engine efficiency. Considerable uneven torque on any one cap, or between several caps, can result in costly engine malfunction.

Various designs of flexible beam torque wrenches are available. These include wrenches that employ double or triple measuring elements, tapered beam wrenches, and dual beam wrenches. Adding measuring elements and tapering the beam tend to further increase the tool's accuracy, and also aid in making the wrench more versatile.

ADAPTERS

Very often, especially when servicing late model motor vehicles, it becomes necessary to add an adapter to the torque wrench in order to gain accessibility into tight

Unless correctly torqued, valve bodies of automatic transmissions can cause erratic transmission operation. This is due in part to the type of valve body material and to the extremely small clearances between the valves and valve bores.

corners. This poses a possibility for improper torque readings if precautions aren't taken to allow for the extra leverage the adapter affords. Adapters are also used to permit torquing of fasteners or components which cannot be handled with an ordinary socket placed on the square drive head of the torque wrench. Some common adapters are the flare nut adapter, a spanner wrench adapter, box end adapter and open end wrench adapter.

If the adapter fits on the torque wrench drive square and extends directly downward, no compensation is necessary to obtain an accurate torque reading. However, if the adapter fits on the drive square and extends outward in such a way as it actually increases the effective length of the wrench assembly, then it is necessary to compensate for the added leverage in order to obtain an accurate torque reading.

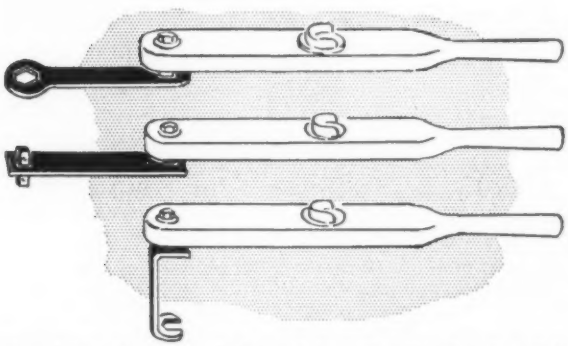
This can be cleaned up a bit by going back to the original fundamental law of the lever: force times *distance* equals torque. Naturally, if distance—the space between the centerline of the drive square and the centerline of the force being applied to the handle—is increased, it will directly influence the amount of torque being applied. Hence, it's necessary to consider the extra length when computing the delivered torque. In many instances, mechanics fail to consider the added length of an adapter when tightening a nut or bolt. It's possible to exceed a fastener's elastic limits while carefully tightening it to specifications without considering the extra leverage a 6 or 8 inch adapter is giving to the basic torque wrench. In industry, when a torque wrench is used continually with a specific adapter which increases the wrench's effective length, the dial is calibrated especially to take care of the extra leverage, and no mathematical computations are necessary to obtain correct torque readings. This is seldom true for the mechanic who may use several adapters, all of different shapes and sizes, in the course of a day's work. His chore of torquing could also be made a little more complex when he's forced to use an extension to either increase the capacity of the torque wrench, or to allow him to reach an otherwise inaccessible spot.

COMPENSATING PROCEDURES

To determine how much torque is produced at the end of an adapter, it's necessary to multiply force times the total effective length of the torque wrench assembly. This is, of course, the length of the lever *plus* the length of the adapter. For example, if the lever length of a given torque wrench is 12 in. and a 3-in. adapter is placed on the drive square, the total effective length of the assembly becomes 15 in. This 15 in. figure is the one which must be multiplied by the force being applied to the wrench handle to arrive at the amount of torque being applied. The mathematical formula for determining the torque exerted at the end of an adapter is as follows:

$$Ta = \frac{Tw \times (L + A)}{L}$$

Ta = Torque exerted at end of adapter
Tw = Torque wrench dial reading
L = Lever length of wrench
A = Length of adapter



An adapter (top) extends forward from the wrench axis and is attachable to the drive square of wrench. An extension (middle view) extends forward from the axis and has at its extremity a drive square for attachments. Thus, the range of the torque wrench is increased. An attachment (lower view) functions co-axially with and is attached to torque wrench drive square.

As an example, let's assume the reading on the dial of a torque wrench is 10 ft-lbs., and the lever length of the wrench is 10 in. To the wrench was added a 4 inch adapter. Substituting these values will give the following:

$$Ta = \frac{10 \times (10 + 4)}{10}$$

$$\text{Then; } Ta = \frac{140}{10}$$

$$\text{Finally; } Ta = 14$$

As this answer indicates, the 4 in. adapter has actually increased the torque reading by 4 ft-lbs. This means that the 10 ft-lbs. indicated on the torque wrench dial should really be interpreted as a 14 ft-lbs. reading. An adapter which equals the lever length of a torque wrench will double the dial reading. An adapter one-half the length

(Continued on following page)

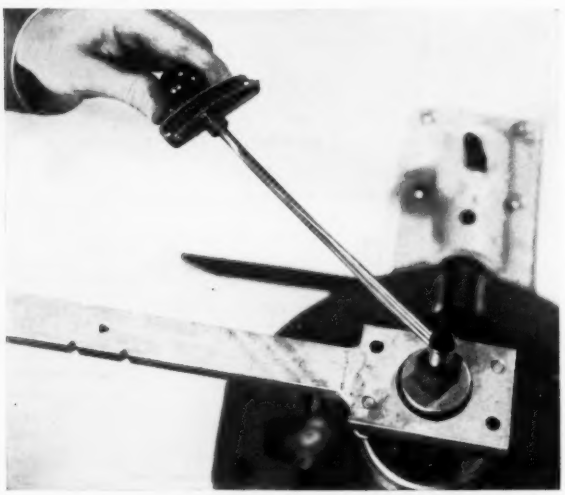
The Truth About Torque . . . CONTINUED

of the lever length of the torque wrench will increase the dial reading by one-half. This is an extremely important fact to remember when using adapters or extensions, placed onto a basic torque wrench. Also, to distinguish between an attachment and adapter, keep these two points in mind:

1—Technically, an *attachment* functions coaxially with the torque wrench drive square.

2—An *adapter*, or an *extension* extends longitudinally forward from the axis of the torque wrench drive square.

To eliminate the need for pencil and paper figuring when trying to compute torque exerted at the end of an



Torque wrenches are invaluable for checking and setting bearing preloads. In the illustration the preload on the drive pinion bearings of a rear axle assembly is being checked.

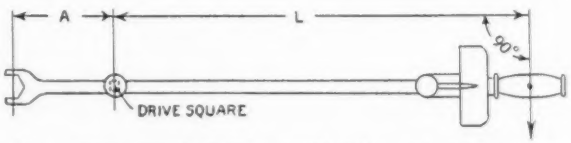
adapter, the P. A. Sturtevant Co. has developed and made available a quick-reference slide chart which automatically delivers the Ta value when set according to the L and La measurements. It is an excellent on-the-job aid for the working mechanic.

OPERATIONAL HINTS

Correct use of a torque wrench is not a difficult procedure. Applied carefully, as any pull-handle, a good quality torque wrench will deliver satisfactory performance for a long period of time. There are, however, two things to keep in mind if accurate torque results are to be obtained in all normal working situations. These two things are *thread resistance* and *fastener seizure*.

Thread Resistance: Damaged or rusted threads can result in erroneous torque readings if they aren't tightened properly. The recommended procedure to follow when working with threads of high resistance is to merely add the thread resistance to the torque specifications. To do this, note the thread resistance—indicated on the torque wrench dial—during the last rotation before establishing the required torque. Then add this amount to the actual torque specification. If it takes 2 ft-lbs. to overcome thread resistance, and the specifications call for 10 ft-lbs. of torque, tighten the bolt or nut to 12 ft-lbs. Be sure to note thread resistance on the last rotation as the resistance may only be present at the first few threads.

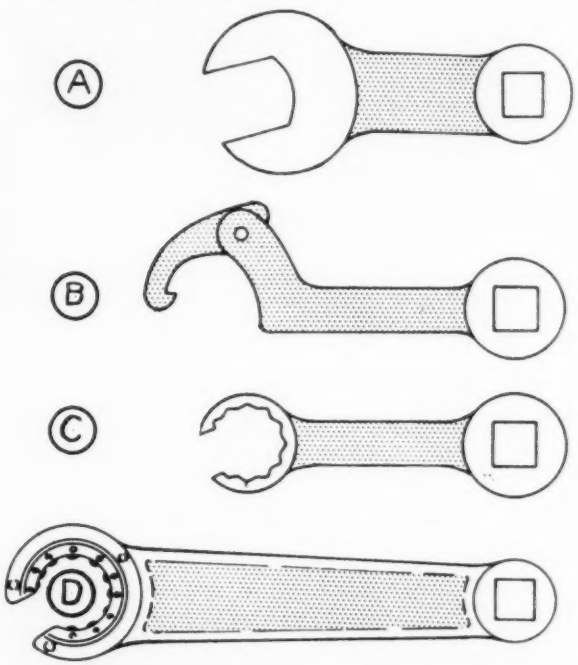
Seizure: Most every mechanic has experienced a popping effect which occurs sometimes during the last stages of the tightening procedure. When this happens, back-off the fastener a half-turn or so, and again apply the wrench



In a torque wrench-adapter combination, the total effective length of the assembly is the sum of the length of the adapter plus the lever length of the wrench, or L plus A. Arrow through handle is applied force.

with a steady, sweeping motion. Take the torque reading during this final sweep. It's not unusual to find a torque reading taken from a seized position to be greater than the torque to which the fastener was originally applied.

A dependable torque wrench in the hands of a skilled mechanic is a valuable tool and in terms of modern precise service requirements a most essential tool. Used properly it provides the only practical method of accurately tightening the fasteners on today's close-tolerance automotive units.



There are many different kinds of adapters, attachments and extensions for torque wrench use. Typical adapters are: (A) open end type; (B) spanner; (C) flare-nut; (D) ratchet type.

Tuning Fords for Altitude Operation

The altitude secondary main metering jets for 1958 Ford cars (four-barrel Ford carbs) have been revised to improve fuel economy and performance.

Carburetor	Application	5 to 10,000 ft.	10 to 15,000 ft.
B8A-9510-A	332 cu.in.	#63 (was #59)	#61 (was #55)
B8A-9510-E	352 cu.in.	#62 (was #58)	#60 (was #54)

By the way . . . if "surging" is encountered with '58 six-cylinder cars or trucks, it is recommended that the standard #59 main jet be replaced with a #62 (Ford #1GA-9533-B).

How is service successfully sold?

Interview*

By BEN M. IKERT
and
GEORGE A. WHITTINGTON

MARTIN E. GOLDMAN, member of the board of Aitkin-Kynett Co., Inc., Advertising, is a widely known marketing authority and pioneer in the development of automotive servicing. He has also served as merchandising director, Motor Equipment Association, and board member, American Association of Advertising Agencies. Goldman helped organize and conduct the first shop equipment clinics and car-factory service promotions, and leading automotive industry campaigns, among them: "The Best Equipped Shop Gets the Business": "Ask 'em to Buy," and state inspections, which were originated as the "Save a Life" program.

• THE SURE ROUTE to profitable operation of an automotive service shop has two clear "markers": ability to handle complicated repair work, and effective promotion of that ability locally.

In his ASD interview, Dr. George H. Brown of Ford Motor Company revealed some of the results of his firm's extensive research. Those findings on how the service dollar is spent, show that car dealer service departments and independent service shops, are the backbone of their specialized industry. They have the equipment and skilled manpower that are "musts" in doing the precision service work modern cars require.

When President James J. Cavanagh of the Chicago Motor Club discussed for ASD readers, the effect of expressway expansion of service businesses, he drew on the experience of thousands of service outlets. It's apparent from his observations that shop success is based on neighborhood customers. Another conclusion must be reached from information Cavanagh supplied—there's a boom in automotive servicing on the way!

WINNING THE FAIR SHARE

With the field both highly competitive and on the upsurge, sound merchandising by automotive shops is more necessary today than ever. So your ASD editors sought the suggestions of a "pro" steeped in marketing and servicing matters alike. We found him in Martin E. Goldman, advertising executive with The Aitkin-Kynett Company, who has lived with the automotive field since its early days. In the interest of our readers, Goldman permitted us to "pick his brains" as thoroughly as we knew how:

***

Question: In previous interviews we've found that, in general, shops rendering multiple mechanical services have an advantage in two respects: (1) they have more highly trained and experienced mechanics; (2) they have the equipment to handle major, complicated repair work. We've also found that the make-or-break volume of service work is obtained from regular, local customers—with transient business being "the frosting on the cake."

Do these key factors suggest any basic ground rules for effective merchandising by service shops?

Answer: There can be little question as to the influence of multiple services upon service sales. Diversified services increase possible car-owner contacts; and the more frequently car owners return to a service establishment, the more opportunities are afforded for inspection of the car and sales of needed services and merchandise.

The profits from sales of diversified services are often invested in test and repair equipment, tools and skilled mechanics, which might not be justified without these profits.

Competent mechanics and good equipment have

*One of a continuing ASD feature series.

proven valuable assets in attracting and holding service customers, and should be more generally exploited. Most service shops are local businesses getting most of their volume from local customers. Many of them could develop more business by active solicitation of new customers.

Many well-equipped service establishments have learned to capitalize on their investment in test and repair equipment and skilled mechanics, and their efficient methods, by bringing these to the attention of car-owner customers, through both advertising and personal selling. They not only use test equipment to detect troubles, but whenever practical, they insist on the car owner seeing the test. The test operation and the findings are carefully explained. Such procedure develops car-owner confidence in the recommendations for servicing and replacement.

Many service businesses have learned to open their shops for car owner inspection—just as restaurants have found that opening their kitchens for customer inspection built confidence and furnished good public relations conversation. The "PRIVATE" — "NO ADMITTANCE" — "FOR EMPLOYEES ONLY"—"KEEP OUT" signs on repair shop entrances, can only encourage suspicion.

Of course it is impractical to have constant and uncontrolled customer traffic through the shop, but it would seem advisable—at certain times—to escort regular customers or prospects through the inner sanctum, to let them see the thoroughness and efficiency of the shop operation. Obviously, this "open shop" policy makes good housekeeping a prime requisite and encourages mechanics to maintain high standards of shop practice.

Question: On the face of it, the national merchandising "fire power" seems heavily concentrated on the side of the petroleum dealer service station operator. Working for him—and therefore against the independent and dealer shops in the competition for service dollars—are national campaigns in TV, radio, consumer and trade magazines, newspapers, billboards, direct mail . . . as well as the credit card system.

Would you say that this marketing situation really constitutes "long odds" against local merchandising success for the independent and dealer shops when it comes to winning a local market? Why?

Answer: Absolutely not! As a matter of fact, automotive service establishments have available to them—through manufacturers and wholesalers of parts, accessories and supplies—more than enough advertising, sales training and merchandising assistance to counteract the "fire power" of the major oil companies.

The many years of continuing national and local advertising of leading brands of spark plugs, storage batteries, oil filters, shock absorbers, brake linings, mufflers, fan belts, waxes and polishes, anti-freeze, tires, independent brands of oil and other high volume replacement parts, accessories and supplies, have developed car-owner knowledge of and respect for these products that makes them easier to sell than the so-called "private brand" products of the major petroleum companies.

Shops that can handle multiple mechanical services have more customer contacts. Each contact provides an opportunity for inspection and sales. ***(Photos courtesy Haig & Patterson, Inc.)***

Educational meetings—on both technical and sales subjects; a complete range of point-of-sale signs and display materials; well-planned, completely organized direct mail campaigns; newspaper advertising mats; radio commercials; TV commercials; territorial analyses; marketing counsel and assistance; are all available to service shops that are interested in expanding sales of service or T.B.A items.

Question: Should the independent shop operator or car dealer service manager usually expect to retain an advertising agency or counsel to handle his local merchandising?

Answer: Most service shops do not, and should not do enough advertising to justify the use of an advertising agency. However, a large metropolitan car dealer or service shop spending substantial sums on advertising can profitably employ an advertising agency. In a few areas, several smaller shop operators have found it practical to use the services of an advertising agency jointly.

Question: If so, how should he go about finding the right person or organization?

Answer: Advertising agencies are listed in the yellow pages of local telephone directories. The American Association of Advertising Agencies, New York City, will send a list of their member agencies in any locale to anyone requesting such information.

Contact with local advertising agencies, to review the types of accounts they handle, and a talk with the agency principals should lead to a satisfactory selection. The advertising managers of local department stores or manufacturers will probably be familiar with the advertising agencies in the area.

Question: If not, where will the independent or car dealer service shop find the skilled merchandising "know-how" that it takes to "bring people in to buy"?

Answer: If a service business does not seem to justify the appointment of an advertising agency, it is often possible and practical to employ on a part-time basis and at a nominal salary, either a retired advertising agency man or advertising manager, or a young person who has taken an advertising course at school and may want to use his evenings or leisure time to earn a supplementary income. A classified advertisement in the local newspaper, or contact with teachers of marketing or advertising courses in local schools, may uncover such assistance.

And finally, independent or dealer shops will find extremely constructive advertising, selling and merchandising assistance available through local distributors of the lines handled. Most manufacturers have well organized programs for dealer use; and the distributor is in an excellent position to work with retailers in selecting and balancing advertising campaigns, and in helping to organize and execute them.

Question: In your opinion, what are some of the most effective methods of merchandising automotive service locally?

Answer: The answer to this question must be prefaced with the statement that advertising and merchandising campaigns should be developed with knowledge of the type of business, its characteristics, volume, location, current problems and long-range objectives of the advertiser. These factors, the type of customers to be solicited, the amount of money available and many other considerations influence both the messages or advertising copy and the media to be used.

A campaign that has produced outstanding results for one business may prove completely ineffective and uneconomical for another.

Most large city service shops get a substantial percentage of their business from a relatively small area. They are, in fact, neighborhood businesses. For this reason it is generally uneconomical to use newspapers, radio, or TV with circulation or coverage that extends far beyond the area from which they can reasonably expect to secure customers. Direct mail and planned-at-the-shop advertising and displays have generally proven the most effective mediums.

In small communities and in suburban areas where the service business can reasonably secure business from more than a prescribed neighborhood, and where the area is covered by a local newspaper,

(Continued on following page)

Well-equipped service shops have learned to capitalize on their investment in test and repair equipment. They have skilled men able to explain and demonstrate the need for suggested services and products.

local radio or TV station, the use of such media is often sound and practical.

Question: The use of novelties by small businessmen is quite popular, and has been for the past few years. How would you rate these "gimmicks" as business builders?

Answer: For the most part, this type of "gimmick" has little sales or advertising value. It has minor value as a public relations gesture, but the same amount of money used to advertise special sales or seasonal suggestions would generally have greater selling and advertising value and probably produce more business.

Question: How can a shop determine how much money to spend for merchandising? Is there some simple "rule of thumb"—such as percentage of the gross revenue—on which a practical percentage can be pegged?

Answer: Five percent of total retail sales has been accepted by many as a reasonable average figure. On some products and services, the gross profit justifies a larger percentage.

Question: Have you any suggestions on the frequency of merchandising by the service shop . . . how often it should advertise, send out a mailing or use whatever other method proves most resultful?

Answer: There are three periods of the year that lend themselves to general service promotions and advertising of service specials. The Spring tune-up—the vacation readying—and the Fall preparation for Winter, have been widely advertised and are featured annually in the campaigns of major oil companies, tire manufacturers and car manufacturers. The cumulative impact of all of these seasonal campaigns has built car-owner acceptance of the importance of the timely services and made them receptive to local advertising at these seasons.

In addition to the three seasonal campaigns, special programs soliciting business as special opportunities arise can be effective and productive. Special muffler promotions have been good during the past few years. Lubrication is an all-season need, and a campaign featuring a lube special is usually effective. Free brake inspections offered periodically have been good business getters. Shock absorber safety check is another service that has proven a good advertising leader.

Continuity is important to the success of advertising, and the use of these special promotions helps maintain continuity between the seasonal campaigns. Another important aid to advertising continuity is the use of customer reminders when it is time for lubrication or other special services.

Question: Do you have any specific suggestions about the "style" that seems to lend itself best to local automotive service merchandising? Do comics get good response . . . or "cheesecake" . . . homemaker appeal . . . picture stories; or does a mixture of styles work out best as a rule?

Answer: Purchase of automotive service usually involves safety of people and protection of property. Frequently, too, the purchase runs into a fairly sizable expenditure. For these reasons, most car owners seem to respond to advertising based upon reasoning and supported by sound and understandable statements of fact. The advertising should not be laboriously technical or difficult to read but

(Continued on Page 58)

Good merchandising includes the best in public relations by shop personnel. The customers who go on their way satisfied give evidence of a thorough selling job.

You can buy JETS

At The Same Price as Regular *Aero-Seal* Hose Clamps!

Here's good news for all users of AERO-SEAL, the finest hose clamps. Now you pay no premium for the new, improved AERO-SEAL JETS. The Jets have a new, exclusive patented feature that permits faster installation and removal. To attach, just push housing to desired position on the band, snugly around the hose and threads of the worm drive screw will drop in the slots. Now tighten the screw to fasten securely. To remove, loosen the worm screw and at the same time lift screwdriver head and clamp will open. Stick to the finest, at no extra cost. Get genuine AERO-SEALS, jet or regular — the hose clamps that out-sell and out-perform them all.

Aero-Seal **JET**

QUICK ATTACH HOSE CLAMPS

BREEZE CORPORATIONS, INC., 700 LIBERTY AVENUE, UNION, N. J.

Front wheel bearing service

Load carrying surfaces of ball and roller bearings are finished with extreme care and will sustain heavy loads if handled carefully, kept clean, properly installed, adjusted and lubricated. Front wheel caster, camber, toe-in and directional control rests squarely on operating condition of wheel bearings.

● INCREASED FRONT END car weight, vehicle speed, along with smaller wheels, puts more work and strain on front wheel bearings. More weight comes from bigger engines, power-operated equipment and greater overhang.

Longer periods of driving at sustained high speed on toll roads and expressways call for extreme care in installing, adjusting and lubricating front wheel bearings. It must be remembered that the car's weight (front) is supported on ball or roller bearings. These bearings are small in comparison to the related parts. Over the years they have given a splendid account of themselves. The fact is these bearings could last indefinitely were it not for dirt, faulty lubrication and incorrect adjustment.

GOOD WORK QUICKLY NULLIFIED

All of the good service work on wheel alignment—camber, caster, toe-in—that have to do with directional control of the car, can quickly be nullified by wrongly executed wheel bearing service. Wheel wobble, lateral run-out, premature tire wear, inefficient brake action often are traced to loose front wheel bearings. Bearings set up too tightly are equally bad, as it produces binding. This causes wear and upsets good steering; cars are not as nimble-footed and safe as with bearings correctly adjusted.

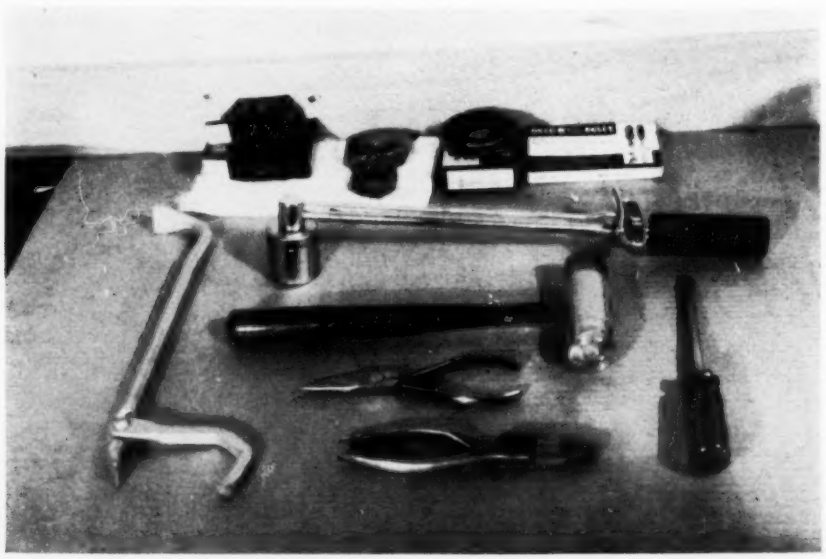
What is correct front wheel bearing adjustment? The answer apparently is not in the use of the conventional design slotted hexagonal nut for bearing adjustment. This nut has several drawbacks.

In using the usual castellated nut, the mechanic ordinarily tightens the nut until pressure retards rotation of the wheel. Then, the nut is backed off until the wheel rolls free without observable play. Next the cotter pin is inserted through the slot of the castellated nut, through the spindle hole, then through the opposite slot of the nut.

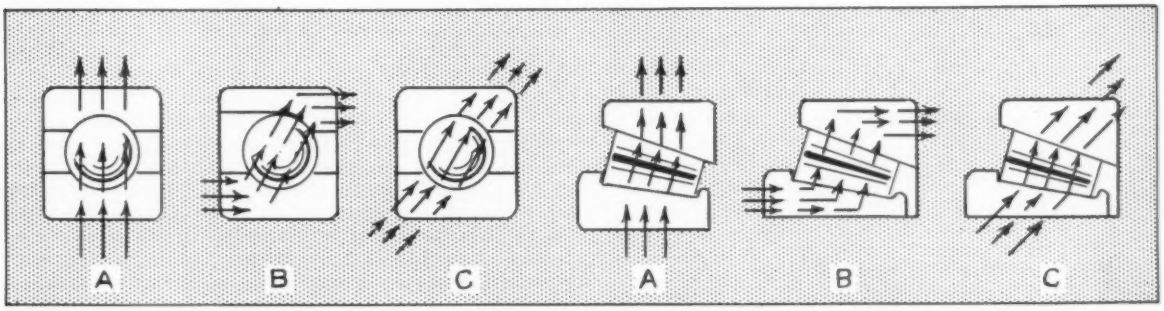
Too often, the nut slots and spindle hole do not line up. Tightening the nut until the hole and slots are lined up means binding the bearing. Backing off the nut means the bearing is too loose. However, many have held that since backing off the nut is the lesser of two evils, that was the thing to do. Thus, it often was a case of either preloading the front wheel bearing or getting a "sloppy" adjustment. It's true that now and then castle nut slots do line up exactly with the hole in the spindle and the desired bearing clearance adjustment is obtained.

Precision adjustment of front wheel bearings, either

By BEN IKERT
Editor



Precision workmanship, the right tools and, equally important, cleanliness are three outstanding requirements for front wheel bearing installation, lubrication and adjustment.



Arrows show how radial (A) thrust (B) or angular loads (C) are transmitted through ball and roller bearings. In service most loading is a combination of radial and thrust loads. Loads also can pass in direction opposite to arrows.

of the ball or tapered roller type is possible by use of the Micro-Nut. This nut gives pin point adjustments to .001" and less, through use of a two-piece unit having as many as 84 serrations or adjusting stations.

Obtaining correct front wheel bearing adjustment by use of the Micro-Nut is a simple matter:

INSPECT BEARINGS WITH CARE

First, remove the front wheels and inspect the bearings for wear and/or damage.

If visual inspection of the wheel bearing lubricant shows a grey metallic color or flaky particles, it indicates a damaged bearing. Should one bearing part reveal damage, remove and replace *all* bearing parts with a new assembly.

Screw the threaded half of the Micro-Nut on the spindle (flat face first) turn the wheel slowly and tighten the nut until the wheel binds.

For accuracy and more efficiency use a micro torque wrench and adjust the bearing. The torque reading for taper roller bearings is 5 ft. lbs.; for ball bearings, 7 ft. lbs. This gives the correct bearing clearance.

Next, line up the slot in the round half of the Micro-Nut with the hole in the spindle. Then, push the round half firmly against the hexagonal part, engaging the serrations of each half.

The final step is inserting the cotter pin, which should be of correct size and firmly clinched.

LOAD TRANSMISSION

Need for maintaining correct front wheel bearing clearance is more readily appreciated when the transmission of loads through ball and roller bearings is understood. In the illustrations, arrows show the load passing in one direction. But, the reverse is also true; the load can pass in a direction opposite the arrows.

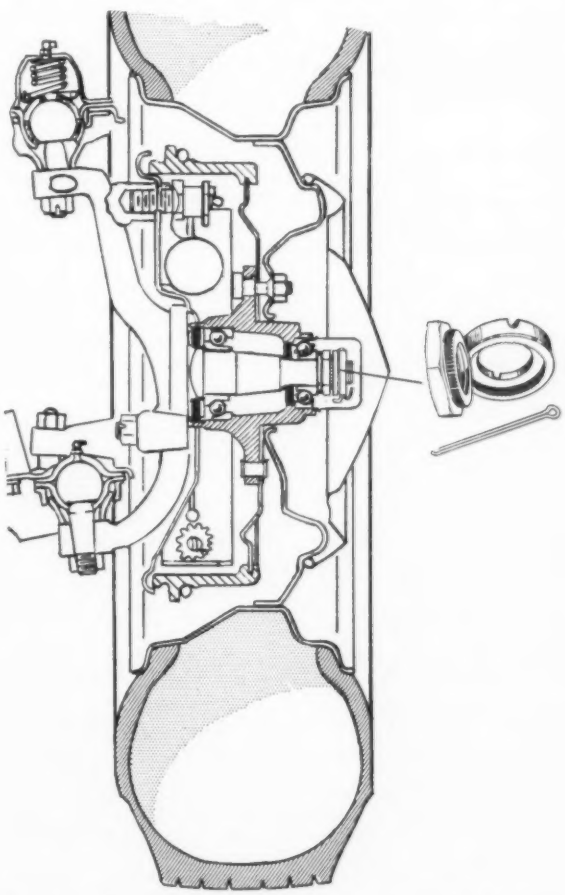
For example, a load on a bearing housing can be transmitted to the shaft and a load on the shaft can be transmitted to the housing. Pure thrust or pure radial loads seldom exist in actual service; usually it is a combination of the two.

Due to the tapered construction, a radial load on a tapered roller bearing causes a thrust reaction which must be taken by an opposing bearing. Thus, tapered roller bearings always are mounted in pairs, as in front wheels equipped with this type of bearing.

The load-carrying surfaces of ball and roller bearings are finished with extreme care and will sustain heavy loads if the bearings are handled carefully, kept clean, properly installed, adjusted and lubricated. Anti-friction bearings will last almost indefinitely unless dirt or abrasive foreign matter gets into them. Abrasive and corrosive matter mixes with the bearing lubricant to form a compound that will quickly lap down rollers or balls.

In normal motor vehicle operation on level roads, front wheel bearing loads are almost entirely radial; but when a motor vehicle turns (particularly at a substantial speed) the centrifugal force produces strong thrust loads. This is the reason why combined radial and thrust bearings are used for mounting front wheels.

The design arrangement of the two anti-friction bearings which carry a front wheel usually is so arranged that the center plane of the wheel is closer to the center

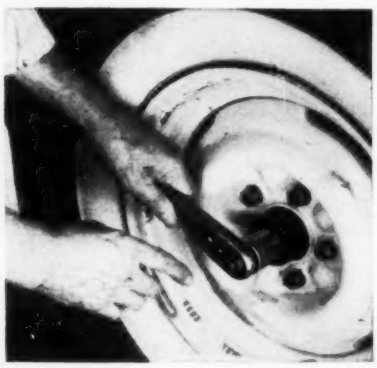


Cross-sectional view of a typical front wheel equipped with an outer and inner ball bearing. Right, close-up of Micro-Nut which is set for correct bearing clearance adjustment and secured (after lining up cotter pin slots with spindle hole) by the round half of nut through serrations. Pin is then easily installed.

of the inner than the outer bearing. The two bearings carry the entire load supported by the wheel, and the load is divided between them inversely proportional to the distances of their respective centers from the center plane of the wheel. This brings the wheel as close as possible to the knuckle pin axis, thereby reducing the stress in the steering linkage and steering effort required.

CLEANLINESS ALL-IMPORTANT

Cleanliness and adjustment are two important points to emphasize in front wheel bearing service. Clean hands, clean tools, clean rags and a clean spot on the bench is half the battle in keeping bearings clean. Always keep the bearings in their original cartons or wrappings until ready for use. Handle the bearings as little as possible;



After replacement of the outer bearing and washer, the threaded half of the Micro-Nut is screwed on to the spindle and tightened until the wheel binds while it is being turned.

finger marks are hard to wash off and perspiration starts corrosion. And, *never* wash the oil or grease out of a new bearing: the lubricant will mix OK with any subsequent lubricant used when the bearing is installed.

These are the important steps in servicing front wheel bearings:

Be sure the car is firmly positioned on a lift or jack. As a preliminary check grasp the tire of the wheel and alternately shake it back and forth. It may indicate a loose or broken bearing. Turn the wheel to see if it revolves freely. Brake may be dragging, or bearing adjustment too tight. Put clean paper or rags on the bench for receiving bearing parts to be removed. The best procedure is to service one wheel at a time to avoid mixing the parts.

After wheel cover or cap is removed, pry off the inner dust cap. Remove the cotter pin from the spindle nut and discard the pin. Remove the spindle nut and washer. Remember that a left hand nut (counter-clockwise) is used on the left wheels of some cars.

Shake the wheel slightly to loosen outside bearing, take out the bearing parts, wrap them in clean paper and place them on the bench.

Care is necessary in removing the wheel—never drag the wheel off the spindle. Keep the wheel centered and pull it towards you. This prevents damage to the seal (should it have to be re-used) and other parts. On bigger cars or trucks, removal of the wheel from the brake drum or hub makes dissembly easier. If the wheel cannot be removed because of a tight brake, turn the wheel while pulling it, or have an assistant work the brake pedal up and down. In obstinate cases the brake adjustment may have to be loosened.

With a clean, dry bristle brush, remove dust and dirt from the brake drum. Wipe off excess grease, put the wheel on the floor with the drum protected against dirt. Protect the spindle with a clean rag.

Next, if wheel has a ball bearing, remove the inner race of the inside bearing from the spindle. Also remove the dust shield, if one is used. The inside bearing and grease retainer are now removed. Remove old lubricant from wheel hub and wipe the hub clean. Clean all bearing parts with a clean cloth dipped in kerosene or Stoddard solvent. Wipe the parts dry, as lubricant will not stick to wet or oily surfaces. Lubricate the bearing immediately to prevent rusting. A bearing washer is useful for cleaning since it forces the solvent through the inside of the bearing cage. Never spin balls or rollers by air pressure.

If inspection of the bearings, either ball or roller type, shows them to be pitted, scratched, indented or worn, replace the entire assembly. Never replace only a part of a bearing assembly, it only invites trouble. And, just as a new gasket should be installed every time a joint is broken, always install new grease retainers or seals on a front wheel bearing job.

While the bearings are out, they should be lubricated. It is generally agreed that a bearing packer is best for this. Roller bearings are particularly hard to pack by hand. Follow the equipment manufacturer's recommendations for use of the bearing packer.

Coat the wheel spindle and inside of the wheel hub with a thin layer of grease to prevent rusting. Do not pack the wheel hub with grease. However, one maker of roller bearings recommends that the hub cavity be filled to the inside diameter of the cups. A large excess of grease increases temperatures, may cause leakage onto brakes and can do no lubricating anyway.

Front wheel bearing lubrication, and in fact the general servicing of these bearings, has not generally been given the same attention as other important chassis units. Perhaps this is because front wheel bearings are pretty well concealed, have no outward lubricating fitting and unless some painstaking mechanic calls attention to them, who is there to remind the car owner about service? Maybe the motorist at one time looked over his owner's manual and observed that the lubrication schedule indicated something like 5000 or 10,000 mile periods for "wheel bearings." But he forgets the whole thing until a worn or

Final adjustment on the threaded half of the Micro-Nut is made with the micro torque wrench. To provide for low torque readings necessary to prevent loading the dial plate is calibrated for 5 ft. lbs. for taper roller bearings and 7 ft. lbs. for ball bearings.

broken bearing, wobbly wheel, snakey steering and scuffed tires prompt his visiting a shop. And all this because of neglected front wheel bearing service.

A good "alinement mechanic" will not touch a wheel alinement job until he makes sure of the front wheel bearing's fitness for further use. All of his excellent work in restoring proper camber, caster and so on mean nothing in the face of worn out or damaged bearings.

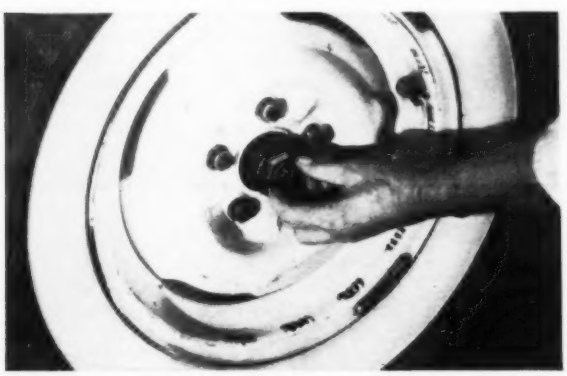
Anti-friction bearings for front wheels, or any other installation for that matter, are precisely and beautifully made. They can take a terrible beating, but given an even break by careful selection and handling, correct installation, adjustment, lubrication and then, proper service, they'll do their work of shouldering and rolling the heavy end of any car or truck.

A front wheel ball or roller bearing in good condition, properly adjusted for correct clearance and lubricated right insures concentricity with the wheel spindle, the hub, brake drum and finally the tire. A loose bearing can throw this whole concentricity off. The inner surface of the brake drum would run out, the wheel would wobble and it takes but little imagination as to the general affect this has on overall car handling.

GREASE INSTITUTE STEPS IN

Over the years the relubrication of front wheel bearings has been a more or less controversial subject and no standard or common procedure existed. However, several years ago the National Lubricating Grease Institute came up with recommendations which have been revised from time to time, culminating in the 1958 edition of "Recommended Practices for Lubricating Automotive Front Wheel Bearings." It has a wide acceptance in the field.

About a year ago the NLGI Spokesman carried an article "To Pack or Not to Pack" from the paper written by E. O. Forster, J. J. Kolfenbach and J. Panzer of the Esso Research and Engineering Co., and based on extensive field tests. This paper provides quantitative evidence

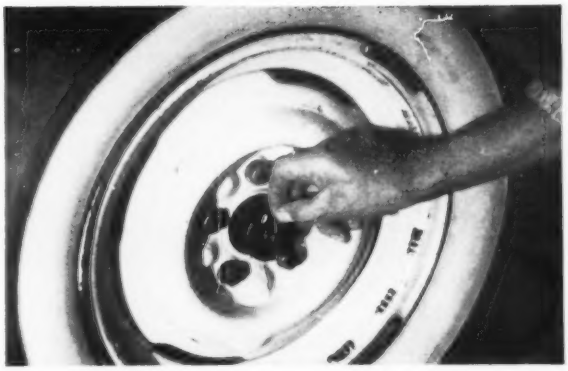


After the hex threaded half of the Micro-Nut has been correctly torqued, the slot in the round half of the nut is lined up with the spindle cotter pin hole. Next, the round half is pushed against the hex nut engaging the serrations of each half.

for the claim that the packing of the hub of automotive front wheels is not necessary. Further proof is provided that the recommended practices are sound. Typical and informative excerpts from the paper are the following:

". . . As to the amount of grease to be used in packing automotive front wheel bearings, no published data are available that would indicate the relative effectiveness of different packing procedures. In general, it is agreed that the use of excessive amounts of grease should be avoided because it may lead to serious leakage. No agreement exists, however, on the proper amount to be used in the hub. Arguments for packing grease in the hub are mainly based on the belief that the grease in the hub acts as a reservoir and provides additional lubricant to the bearings. . . .

". . . To prove or disprove the contention that incomplete packing of the bearing in the absence of grease in the hub might lead to premature bearing failure, two more passengers cars were put on test. In these units, the bearings were packed with less than the equilibrium amount of grease found in the previous phase of these tests and only a thin film of grease was packed in the hub according to the recommended NLGI procedures. The results indicate that after 18,000 miles, representing half a year driving under severe service conditions, the bearings were in excellent condition in spite of incomplete packing . . . the amount of grease in the bearing had not changed. Nevertheles, under actual operating conditions, it would be advisable to have the bearings completely packed to prevent the entrance of foreign matter such as dirt and moisture."



The final step in locking the adjustment is to insert a new cotter pin of correct size in the slots of the Micro-Nut round half and through the spindle hole.

From the results of the field tests by Esso's engineers the following conclusions were drawn:

1—The NLGI recommended practice of packing no grease in the hub of automotive wheel bearings provides satisfactory wheel bearing performance.

2—If this method is used together with the mechanical bearing packer or with careful packing of the bearings by hand, adequate bearing lubrication will prevail throughout the recommended service period, provided qualified lubricants are used.

3—Quantitative evidence is produced to show that under the conditions specified in 2, the bearings will establish an equilibrium amount of grease by throwing out excess lubricant, and this fact contributes to the conclusions drawn in 1, that the NLGI procedure is satisfactory and no grease beyond the thin film is necessary in the hub.

Rerouting Power Steering Hose Eliminates Failure from Chafing

Power steering hose interference with the left front spring and left front upper suspension arm has been encountered on a few Edsels. According to the factory, the movement of the front suspension chafes the hoses, which may result in hose failure. It is therefore recommended that the routing of all power steering hoses be checked, and where found necessary, repositioned so as to eliminate contact with any moving parts of the front suspension system.

Servicing the Peugeot 403

General knowledge of the design, observance of necessary clearances, tolerances and torquing specifications opens the door for custom or general maintenance applicable to this small import motor car.

• SERVICING IMPORTED CARS needn't be *foreign* to you. First you'll need a set of metric wrenches, but from there the job follows sound every-day service fundamentals.

Take the Peugeot. The 403 is a direct descendant of the 203, having been infected with the American urge for more horses. The higher output has been obtained principally by the use of the reamer and the miller—more bore and higher compression.

For the sake of comparison some of the more vital statistics on the 203 as used in the original 4-door models; and the new 403, both in a 4-door and a convertible are listed in the adjoining column.

The values listed are all based on English standards—the inch, the U.S. quart, and the U.S. gallon. Fuel consumption and speed are approximations and not offered as records.

PEUGEOT SPECIFICATIONS

	Model 203 4-door	*Model 403 4-door*	*Model 403 Convert.*
Engine	4-cyl.	4-cyl.	4-cyl.
Brake hp.	45	58	61
Displ. (cu.in.)	78.7	89.55	89.55
Comp. ratio	6.9:1	7:1	7.4:1
Bore	2.955"	3.152"	3.152"
Stroke	2.8762"	2.8762"	2.8762"
R.P.M.	4,500	4,900	4,900
Coolant capacity	9.5 qt.	9.5 qt.	9.5 qt.
Oil capacity	4 qt.	4 qt.	4 qt.
Fuel capacity	13 gal.	13 gal.	13 gal.
Top speed (claimed)	71 m.p.h.	82 m.p.h.	87 m.p.h.
Gas mileage (claimed)	27 m.p.g.	26 m.p.g.	26 m.p.g.

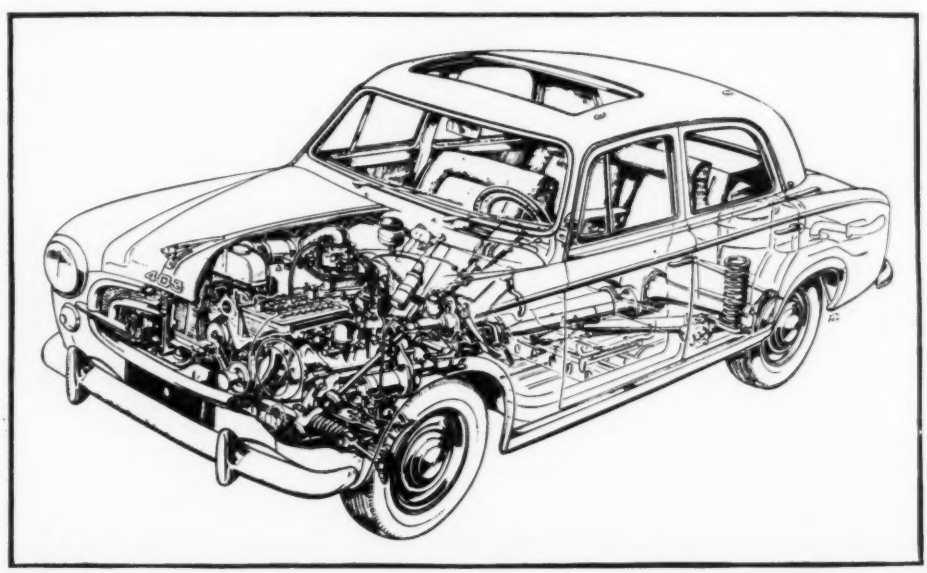
When one of these little jobs rolls into the shop, pulling back on the hood latch knob located to the left of the steering column on the instrument panel, will release the hood. Then pressing up on a safety latch in the space above the grille and below the partially raised hood (just about at the center) will allow you to put up the hood. There's a good solid rod at the right front corner of the hood that holds the hood safely in the raised position.

The engine and its accessories, as viewed from the left side of the car, are pictured in Figs. 1 and 2. The accessibility of all parts for service is refreshing to the experienced mechanic.

Not identified in Fig. 2, but just barely "squeezed" into the picture and barely recognizable are the fan, fan belt, and generator. That little lever close to the generator is standard equipment on all Peugeots, and controls the flow of coolant through the car heater. Not seen in the picture, but very close to the generator is the generator regulator.

Part III of a feature series

By ED PACKER
Member S.A.E.



The Peugeot 403

Now that we've had an introduction to the principal parts, let's consider the more frequently needed services.

In connection with any tune-up, it's good procedure to test and know that your compression pressure is uniform within 10 lbs. Making a compression test on the Peugeot requires a gauge that will reach down through the spark plug tubes, a matter of about 10".

SPARK PLUG SERVICE

At first glance the spark plug installation may appear to be a "sticker." But it's all quite simple. Fig. 3 shows at the top a long spark plug socket which is included with every Peugeot. Naturally the mechanic is not going to ask the car owner to lend him a spark plug socket! So the No. 1 tool in the kit of the man who would service these cars is a long tubular socket especially for this job.

Note at the bottom of Fig. 3 the tubular insulator—A. The coil spring is generally left on the spark plug while cleaning, testing, and adjusting. It has to be transferred to a new spark plug before installation. Plug gap is .024".

The insulating tube on each spark plug is given a fraction of a turn *left to release* the tube and to release the secondary wire from the tube. It's given a fraction of a *turn to the right to lock* the secondary wire into contact with the coil spring of the plug, thus completing the circuit from the distributor cap to the plug.

If you wish to remove only a secondary wire, give the insulating tube about ¼ turn left. When replacing the wire be sure that the wire is not riding loose. After the wire is back in the upper end of the insulating tube, fasten the whole assembly securely by giving it a fraction of a turn right.

BATTERY

Battery service is conventional. The high discharge test of this 58 ampere hour, 12-volt battery should be made at 174 amperes. If on this test, the overall voltage of the battery shows 9 volts or better, all is well. If the battery must be removed, two wing nuts on a spring-loaded clamp will release the battery. Turning the T-shaped terminal (T in Fig. 1) several turns to the left will release that terminal. The terminal at the other end of the battery is constructed as in Fig. 4, and is readily removed without tools by turning the plastic knob all the way off of the threaded post.

DISTRIBUTOR

Distributor service is conventional on the Peugeot. Contact points should be kept clean and square—replaced

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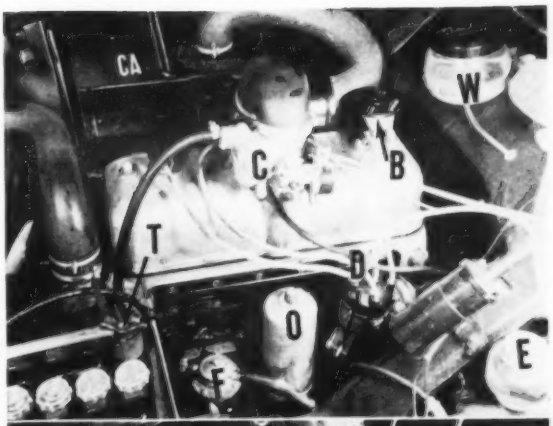


Fig. 1. Left side of Peugeot overhead valve, 4-cylinder engine. B—engine oil filler. D—distributor, with arrow pointing to timing adjuster. E—visible-type brake fluid reservoir. F—fuel pump with priming lever below. O—oil filter secured by single nut on top. T—battery. Terminal opens circuit when given 2 turns counterclockwise. W—windshield washing fluid container. C—carburetor.

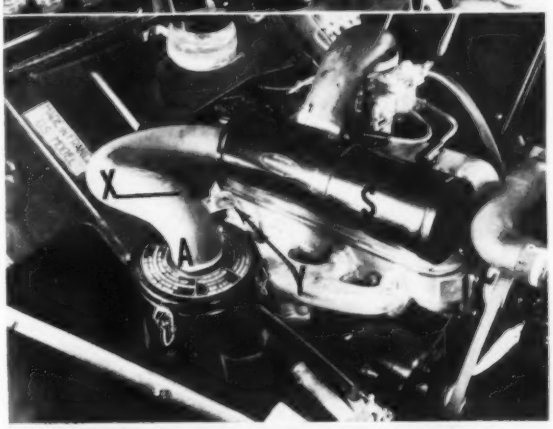


Fig. 2. Right side of Peugeot engine. A—air cleaner. S—intake silencer. X — cooling system drain lever. Y —engine oil dipstick.

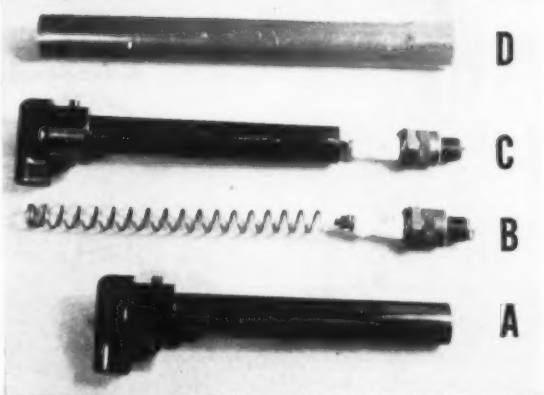


Fig. 3. Spark plug service details. A—spark plug insulating sleeve. B—plug with spring secondary attached. C—plug and spring with insulating sleeve in place. D—long hollow spark plug socket.

Fig. 4. Details of battery cable terminal.

The Peugeot 403 . . . CONTINUED

when badly burned. The distributor should have tension of 18 ozs. and a gap of .015" on the moving contacts. See that the cam of the distributor is free to rotate a few degrees back and forth when gripped between the thumb and finger. Keep the advance mechanism well oiled by putting a few drops of light engine oil on the wick under the rotor (see Fig. 5).

Engine cylinders are numbered the opposite of American practice—the No. 1 cylinder being next to the firewall, and No. 4 next to the radiator. The firing order is 1-3-4-2; distributor rotation is clockwise.

Check the vacuum advance unit by placing an extension of the vacuum tube V in your mouth and sucking on it to see if the distributor advance mechanism moves. If it does not, then determine the cause of binding, free it up, and lubricate it. When sucking on the vacuum unit causes the mechanism to move, it should hold in position when the tube is plugged by the tongue. Failure to hold position indicates a leak. And if the leak is not in the tubing then it is in the diaphragm of the vacuum unit, and the unit should be renewed. *This part is never to be repaired.*

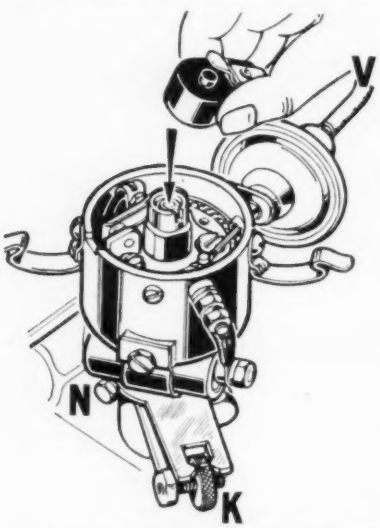


Fig. 5. Sketch of distributor showing: V—vacuum unit; K—knurled timing adjuster; N—nut and bolt of distributor clamp.

POWER TIMING

Power timing is accomplished by turning the knurled screw (K) in Fig. 5 so that the engine does not ping on hard acceleration. This timing is accomplished by driving the car until fully heated and then accelerating in high gear from low speed to see if the engine pings. If so, the distributor housing is moved clockwise with the aid of the knurled screw until the ping is just relieved.

The usual distributor clamp held with a bolt and nut (N) in Fig. 5 is also provided for original setting of the distributor, or should greater movement be required than is provided by the adjusting nut (K).

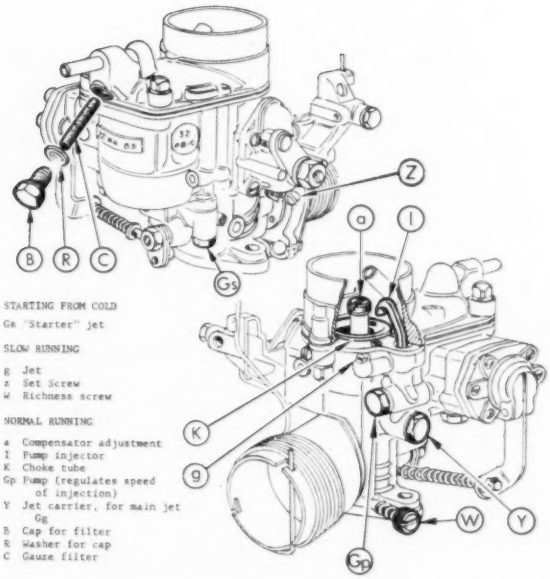


Fig. 6. Details and points of adjustment of the Solex 32PBIC carburetor.

STARTING FROM COLD
Gs "Starter" jet

SLOW RUNNING
g Jet
z Set Screw
W Richness screw

NORMAL RUNNING
a Compensator adjustment
I Pump injector
K Choke tube
Gp Pump (regulates speed of injection)
Y Jet carrier, for main jet Gg
B Cap for filter
R Washer for cap
C Gauze filter

CARBURETION

A Solex carburetor (#32PBIC) is standard equipment, though on occasion a Zenith 34WI carburetor may be used. Each carburetor has a gauze fuel filter in or at the fuel inlet connection. The filter with the Zenith is inside the round end of the fuel line, and will come out with the hollow bolt that holds the fuel line to the carburetor.

The filter for the Solex is in the fitting to which the fuel line attaches, and can be removed without disturbing the line. Service details of the Solex are seen in Fig. 6.

The overhead valves should be maintained with a cold clearance as follows: .004" for all inlets; .008" for all exhausts. Cylinders are numbered from the firewall to the radiator. Exhaust valves are on the right of the head, with intakes on the left. Here is how to position the engine in order to adjust the rocker-arm-to-valve-stem clearance (Fig. 7):

Exh. Wide Open			Adjust					
Cyl.	No.	1	In.	No.	3	Exh.	No.	4
"	"	2	"	"	1	"	"	3
"	"	3	"	"	4	"	"	2
"	"	4	"	"	2	"	"	1

DON'T OVERLOOK AIR CLEANER

To clean the air cleaner, release the three bails that hold the lid on the air cleaner and lift out the cleaning screen. This can be done better for service by removing this element from its air hose by taking off the hose clamp (Fig. 8). Wash the screen in kerosene or a washing-type gasoline and shake it dry. Drain the oil from the air cleaner shell, and refill with engine oil to the white mark on the cleaner. Reassemble by tightening the hose to the upper unit and clamping the upper unit into the lower shell.

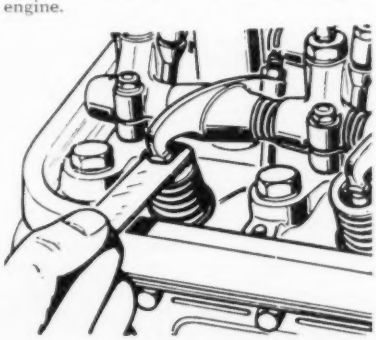
SERVICING BRAKES

When performing any service on the Peugeot, always look at the sight-type brake fluid reservoir on top of the master cylinder. Add heavy duty brake fluid as necessary to maintain the level at the mark on this reservoir (Fig. 9).

To adjust brakes, jack up the car (or one wheel at a time) so that the wheels are free to turn. With a brake-adjusting wrench for the square-headed adjustment (two on each brake backing plate), proceed as follows:

Front wheel: Turning the front wheel slowly by hand, turn the

Fig. 7. Checking valve lash on Peugeot engine.



square-headed adjusting screw toward the *front* until the shoe locks the drum. Then turn this screw slightly in the opposite direction until there is no longer any drag between the shoe and drum. Go through the same procedure for the other square-headed adjustment on the same wheel. Then follow the same procedure on the opposite front wheel.

Rear wheels: Turn the square-headed adjustment just the opposite that you did for the front wheels—*toward the rear.*

Summarizing: Turn the front to the front, and the rear to the rear. Turn each until it locks, then back it up until it is just free.

Fuses for the Peugeot are of the circular type, and go in place like a washer on a bolt.

Each car is provided with a set of replacement fuses together with the special bulbs for the interior lights of the car. Those who contemplate extensive servicing of imported cars would do well to check with local dealers or their jobbers for a modest stock of fuses and bulbs.

Owners of imported cars seem to take special delight in the smoothness and quietness of their vehicles. These qualities, however, are not too easy to maintain.

The use of products such as Sil-Glyde on all rubber buttons and similar mounts of the hood and trunk or on rubber strips around the doors is a plus service that makes you popular with your customers. And the use of special lock lubricants—especially in the winter months and before washing a car—will make your shop long remembered—and very favorably.

Fig. 8. Air filter lifted out for cleaning.

Fig. 9. Adding brake fluid to visible type master cylinder reservoir.

Avoid Strong Arm Methods With Resistance Type Wire

With resistance type wire now being used on practically all new passenger cars, mechanics should avoid using strong arm methods when pulling leads off spark plugs.

Recommended method is to grasp only the molded spark plug cap, rotating it slightly to break adhesion to the ceramic. If you insist on jerking off the wire, look for separation at the terminal connections or a break in the carbon "string."

The Case of the Shaky V-8

Patient: Late Model V-8.
Symptoms: Lope and roll at idle.
Diagnosis: Crossfire? Could be. Ignition wires haphazardly placed under cover plates. Wires rearranged to reduce crossfire, but engine continues to shake, rattle and roll.

Carburetion? No evidence of carburetor air leaks. Idle adjustment has no effect.

Shorted spark plug boots? Nope. Rubber covers were replaced during last plug change. No indication of shorting over outside of plugs.

Worn out plugs? Inspection shows proper gap spacing, very little deposit buildup. Keep looking.

Heat riser valve? *Now, we're getting warm!* This one is stuck tighter than Jack Benny's bankroll. Plenty of back pressure here.

Remedy: Free up heat riser valve. Engine now runs smooth as silk.

Tool Tips *for the Mechanic*

Ford-Mercury Gasket Holder

The Snap-on® GA-62 Water Pump Locator is a handy and efficient gasket holder and intake manifold locator on the Ford and Mercury. See page 78 of Snap-on Catalog W.

Buick Valve Lifter Service

The Snap-on CF-101 Piston Pin Extractor Set works fine for pulling Buick hydraulic valve lifters. See page 87 of Snap-on Catalog W.

NEW TOOL

Snap-on S-9480 Torsion-Aire Height Gauge for Chrysler Products

With this tool you can determine if the Torsion-Aire suspension is out of level and make adjustments accordingly. Simply attach gauge to torsion assembly, set adjustable sleeve at left to manufacturer's recommended height setting. If liquid level at center shows on 0, torsion setting is correct. If gauge is off 0, tighten or loosen torsion bar to bring gauge reading to 0. Use on all Chrysler products with Torsion-Aire suspension. Ask your Snap-on man for full details.

Voltage Regulator Service

The Snap-on TMA-3 3/32" Hex Head Screwdriver and Snap-on Midget Handle are just the tools for adjusting 1958 Delco-Remy voltage regulators. See page 10 of Snap-on Catalog W.

Stop Light Switch Service

Use the Snap-on A-167 Ratcheting Spanner to service the new type stop light switch. Most new cars are now using a slightly off size (between 15/16" and 1") switch. Regular wrenches will not service, but the A-167 works fine. This tool is originally designed for turning speedometer cable nuts at the transmission end. See page 78 in Snap-on Catalog W.

Get your copy of the new Snap-on Catalog W. Ask your Snap-on man or write direct. Watch for further Tool Tips in future issues of this publication.

SNAP-ON TOOLS CORPORATION
8018-KT- 28th Ave. • Kenosha, Wisconsin

Servicing suspension systems

Wheel balancing, front-end alignment and front-end overhaul, make up a major area of profitable work. But to cash in properly . . . with benefit to both shop and customer . . . takes know-how, craftsmanship and proper equipment. Here are the basics for doing the job right, and very likely, far more often.

Part II—Ball Joint Suspension

• A FUNDAMENTAL GOAL of all automotive engineering is to increase efficiency, cut down weight, and reduce the number of moving parts. Seldom can this three-part goal be attained with a single shot. Take the design change from solid axle to independent front wheel suspension, for example. Weight was cut down because the heavy leaf-type front spring was eliminated, as was the solid axle. This was highly desirable. Any unnecessary weight in the front end suspension components is bound to have a minus factor when it comes to riding comfort, stability, and over-all handling ease.

Independent front wheel suspension also increased the efficiency of the suspension assembly. As pointed out in Part I of this series, SLA (short and long arm) suspension practically eliminated "tramp" and "wheel wobble" as well as offering better riding qualities, greater directional stability, and prolonged tire life. So far so good. The change from solid axle to SLA suspension satisfied the first two parts of our three-part goal; weight was reduced, and efficiency was stepped up. But what about the third part, that of reducing the number of moving parts? Well, this brings us to another interesting rule of engineering—*the compromise.*

SLA suspension *did not* reduce the number of moving parts. In fact, it *increased* the number. It actually violated the third part of the fundamental goal, yet it was adopted across-the-board in the automotive industry. Why? Well, because the design offered such dramatic improvement over the old design that every one appeared willing to accept a little bit of bad along with a lot of good. This is known as an engineering compromise. It's nothing new. There's no such thing as perfect engineering. Compromises

By HERB CARRIER
Detroit Editor

A spring compressor is used during overhaul of a ball joint suspension system. The compressor is installed after the telescopic shock absorber has been removed. Note that the brake drum assembly is hung away from the control arm assemblies to prevent damage to drum and hydraulic hose.

must be made all along the line. It's inevitable that there will be a little bit of good in the worst of things, and a little bit of bad in the best of things. This old saw applies to engineering as well as to people. But, in engineering, work constantly goes on to reduce the compromise and improve the product.

KING PINS ELIMINATED

Starting in about 1954, SLA suspension underwent a basic change that served to further increase its efficiency and remove its greatest weakness—too many working parts. The new design called for ball joints to be used instead of king pins.

You'll recall that the king pin served as a means of connecting the steering knuckle to the knuckle support. Bronze bushings in the steering knuckle, and a thrust bearing placed between the lower yoke of the steering knuckle and the lower boss of the knuckle support, provided the bearing surfaces upon which the steering knuckle could pivot about the knuckle support. The bronze bushings constituted the source of greatest wear. These had to be lubricated periodically and properly. Even then, lubrication only served to help assure a normal life span. Bushing wear was bound to occur, and excessive wear was only a matter of time. By eliminating the king pin, the king pin bushings, and the thrust bearing, a considerable reduction was made in the number of moving parts. Also, the outer pivot points of the upper and lower control arms were eliminated, which further added to the advantages of ball joint suspension. With ball joints, it's possible to reduce the number of lubrication points from an average of five per side to two per side. This reduction of lube points obviously means fewer moving parts.

AVERAGE CONSTRUCTION

A typical ball joint front suspension system used in American produced cars consists of a coil spring which is mounted between the lower suspension arm and the frame. A telescopic, hydraulic shock absorber passes through the coil spring. Its bottom eye connects to the lower control arm, and its upper stem on the vehicle frame. An upper control arm is supported by an inner shaft which is connected to the frame side rail through a bracket. The lower suspension arm is bolted, through rubber bushings, to the front frame crossmember.

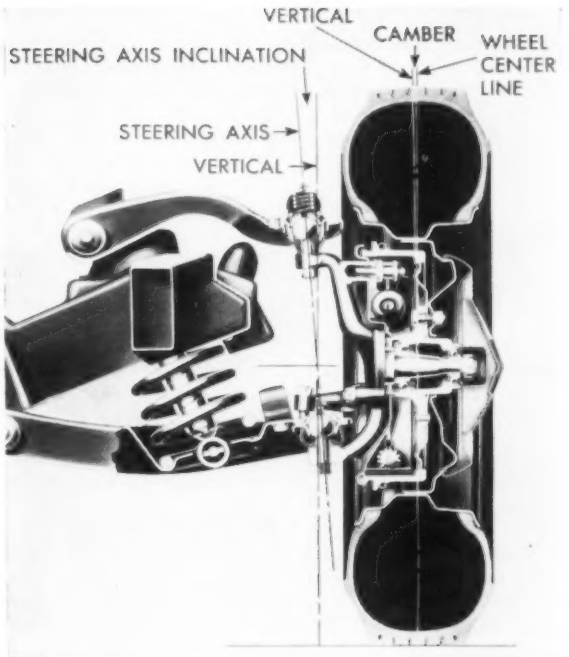
At the outer ends of the upper and lower control arms are mounted the ball joints. These are usually attached by rivets, or by specially hardened bolts and nuts. The tapered studs of the ball joints are connected to the spindle. In addition to the tapered fit, the ball joint studs are held in the spindles by cotter-pinned nuts—the first inch of the studs being threaded.

BALL JOINT DUTIES

The lower ball joint is called the high-load carrying unit. It carries a good share of the vehicle's front end weight. Consequently, its construction must be rugged enough to withstand heavy duty operation.

A typical lower ball joint consists of a forging—the part connected to the lower control arm—which contains a hardened, stamped insert. The insert is knurled on the outer diameter to prevent its turning within the forging. Next comes a spherical bearing with its outer surface in contact with the insert. The ball joint stud contacts the inner surface of the spherical bearing through a ring of steel balls. The load is transmitted through the stud, to the ring of balls, to the spherical bearing, to the hardened insert, to the forged mounting, and finally to the lower control arm.

The upper ball joint is called the light-load carrying unit, and resembles the lower joint in appearance and



Modern ball joints are located on the king pin line. This design feature adds to over-all operating performance and good steering geometry.

construction. There is but one major exception. The upper ball joint is assigned the duty of reducing the gyroscopic forces of the front wheel by creating a "dampening effect."

The ball, or roller bearing arrangement of the lower ball joint provides a free turning design so that the front wheel can be easily steered without undue resistance from the head of the ball joint stud twisting on the hardened insert. In the upper ball joint, the free turning feature is not wanted. This joint must deliver a stabilizing effect to

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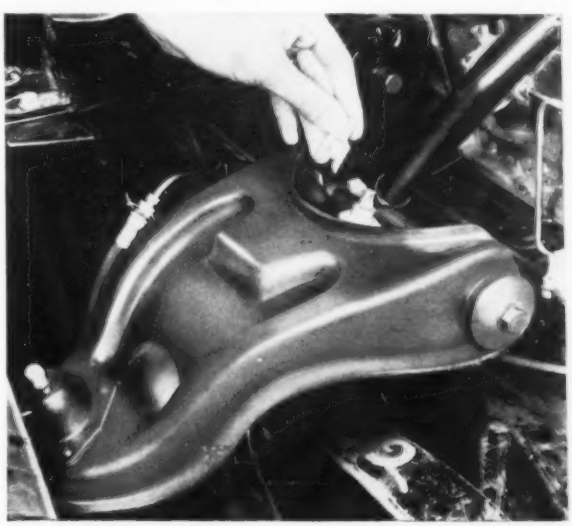
Spade shaped shims are used to control caster and camber. By adding or removing shims from the front or rear bolts, which hold the upper control arms to the frame, correct alignment specifications can be obtained.



reduce the gyroscopic effect of the wheel.

For this reason, the upper ball joint stud is of the "flat top" design. This stud head is flat, and works against two flat metallic discs which are separated by a fabric washer. Spring pressure is applied to the upper washer to cause a considerable resistance to the turning of the stud. This feature of the upper ball joint is called the "clutch action."

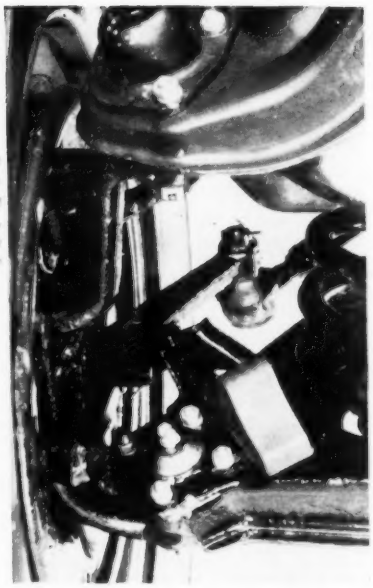
VARIOUS DESIGNS

The use of ball joints for front suspension of automobiles is not new. As far back as 1900, a patent was issued an Englishman named Lancaster for a design of front wheel suspension which included the use of ball joints to connect linkage from the front axle to the carriage-type body. Several other inventors came up with unique uses of ball joints in the years between 1900 and 1953. These include Porsche and Daimler-Benz.

In the early 1950's a new use of ball joints appeared in American built, mass-produced automobiles. The newness of this suspension was not in the ball joints themselves, but in the design principle of combining a free turning ball joint for the load carrying member, and a tension mounted ball joint for steering dampening. Since the original introduction of this principle on a mass-produced scale, the idea of using ball joints for front suspension has swept the industry. Today, practically all major automotive manufacturers employ ball joints in their front suspension assemblies.

Not all systems are identical, however. The arrangement of the ball joints is very similar, but the design of the joints themselves can vary between several different vehicles. For example, some manufacturers use different methods of designing the upper ball joint. The clutch action principle is only one means of doing this. Also, the type of bearings, seals, and inserts of the lower, free-turning ball joint are not necessarily identical among different vehicles using ball joint suspension. However, in general, it's safe to say "ball joints is ball joints—why split hairs?" There isn't really enough difference to merit an exhaustive study. An understanding of a typical ball joint suspension system will serve as a "sound-in-principle" understanding of all current ball joint systems.

Special holder and spacers are used to remove and replace the control arm rubber bushings. Attempting bushing replacement without proper tools can often result in control arm distortion.



Special nuts and bolts are used to attach the replacement ball joints to the control arms. The original joints are ordinarily attached by rivets.

SYSTEM ADVANTAGES

In late model American built cars, ball joint front suspension systems offer the following advantages:

1. **Front suspension bind is eliminated.** This is good because it prevents front suspension stiffness that can result from misalignments incurred during production and assembly of the conventional king pin and bushing type suspension. Service installation and front end overhaul can also cause the king pin suspension to bind if proper procedures and good craftsmanship aren't followed very carefully.
2. **Suspension action and steering motion are combined at one point.** This makes for a simpler, cleaner installation which, in turn, makes for a less troublesome installation requiring less maintenance and upkeep.
3. **Dampening control is provided at the wheel in the steering motion about the king pin line.** This is desirable from a standpoint of steering geometry contributing to greater stability and control.
4. **Easier steering.** The free turning action of the lower ball joint due to the ball, or roller, design, considerably reduces the effort required to turn the front wheels. It must be remembered that the lower ball joint carries the greatest share of the vehicle's front end weight. Therefore, steering ease depends upon how easily the stud of the lower ball joint can be turned in its housing.
5. **Increased engine compartment space.** Because modern ball joints are located on the king pin line, it's possible to move the inner pivots of the upper and lower control arms outward an amount equal to the distance between the original pivot points and the king pin line. In other words, the absence of the steering knuckle support means that the upper and lower control arms can be moved outward from the center of the vehicle an amount equal to the space the support occupied—a distance of a few inches on either side of the frame.

   This is a great boom to the majority of automotive manufacturers who are moving toward shorter, wider engines. A few inches of increased width in the engine compartment is like money from home to the stylists and designers of today's cars.
6. **Space for greater upward wheel travel is possible.** If a particular automotive manufacturer did not need

extra engine compartment width, or if he had to *compromise* between width and wheel travel space, he need only extend the length of the upper and lower control arms which would retain the front wheel track to where it was with king pin and bushing suspension. It can be seen that longer control arms would result in greater possible travel of the front wheels.

7. **Easy to service.** It's much easier to replace a ball joint than it is to overhaul the king pin and bushing assembly. In the ball joint system, there are no king pins or bushings to drive out, no new bushings to drive in, and no reaming necessary to fit the bushings to the pins. In addition, it's not always necessary to re-align the front end after ball joint replacement because any wear occurring on the ball joint is in the direction of the king pin line, although most manufacturers recommend checking caster and camber adjustments after *any* component of ball joint suspension has been replaced.
8. **Longer life.** Ordinarily, ball joint life is much greater than the life of king pin bushings.

The upper ball joint, being spring loaded, will usually appear snug even when the front wheel is jacked off the ground. Knowing when to recommend ball joint replacement can be a problem. If the ball joint has been neglected, and squeaks because of lack of lubrication, the problem is solved. Simply replace the defective unit. But when a customer asks you to check the front end of his car for loose ball joints, you've got a real chore.

About the only way a ball joint system can be accurately checked for excessively loose ball joints is to remove the studs from the spindle and check the torque necessary to turn the upper ball joint stud in its housing. This can be done either by using a torque wrench placed on the stud nut, or by using a spring scale attached to the cotter pin hole in the stud. Manufacturer's specifications differ, but if the stud can be moved with less than 8 pounds of force on the spring scale, or 2 ft. lbs. on the torque wrench, it is considered excessively loose and must be replaced. Maximum torque is 15 ft. lbs.

Rule of thumb says that the ball joints wear at about the same rate. So, when the upper joint needs replacement, the lower joint should also be replaced.

Rubber torsional bushings—secured in place by bolts and washers—are pressed between the control arms and control arm shafts. These bushings are usually of natural rubber, and require no lubrication.

9. **Better braking.** Ball joint suspension makes it possible to attach the brake anchor pins directly to the spindle support. This transfers braking force directly from the anchor pin to the spindle support. By-passing the backing plate reduces one cause of vibration and noise.
10. **Easier maintenance.** The reduction of lubrication points makes ball joint systems easier to grease, and helps prevent the lube man from overlooking vital points.
11. **Easier riding.** By eliminating several parts, ball joint suspension systems have less unsprung weight. This means, of course, increased riding comfort.

INSPECTION

Ball joints can be difficult to check for wear if their operating principle isn't understood. For instance, jacking up a front wheel and alternately pushing in on the bottom of the tire and out at the top to check for any looseness in the lower ball joint will invariably indicate the lower ball joint is loose, and must be replaced.

This is not a valid check because the lower ball joint is not spring loaded. Therefore, when the weight of the vehicle is removed from it, as when the front of the car is jacked off the floor, the stud is free to turn easily within its housing. When the jack is removed and full vehicle load is applied to the joint, it's loaded to a smoothly-functioning assembly.

REPLACEMENT

Design differences between makes of cars can reflect in ball joint replacement procedure. Usually, however, the procedure variations are only slight, and one removal pattern can be applied to most every make. The following replacement procedure is pertinent to one specific model, but is applicable to all popular makes that employ similar ball joint suspension systems:

Removal:
1. Remove shock absorber.
2. Raise front of vehicle and support weight on stands placed under the frame side rails.
3. Remove tire and wheel assembly to avoid unnecessary damage to the joints during removal.
4. Loosen, but do not remove, the bolts attaching the lower control arm shaft to the frame crossmember.
5. Install a spring compressor, and tighten enough to slightly compress the spring.
6. Remove the lower ball joint cotter pin and retaining nut. Jar stud loose from tapered hole in the steering knuckle by rapping the steering knuckle a sharp blow with a heavy

(Continued on page 78)

AUTOMOTIVE BUSINESS KNOW-HOW

"So you want to open a service shop?"

It's like leaving home to "go on your own" the first time. Here's "boot training" for the ex-salaried-employe embarking on the tossing seas of independent enterprise.

By HERB CARRIER, Detroit Editor
and
DR. GEORGE A. FIELD, Wayne State University

• IF YOU HAVE FOLLOWED faithfully the suggestions on advertising, display and promotion up to this point (or better still, if you have developed your own original program by improving on some of them), you've got prospects in your shop. You know your products. You've got your sales personality whipped up to a fever pitch. You can show tremendous personal interest in each and every prospect, and you really want to sell. Like a trembling debutante, you're all set to go. The curtain rises, you're face to face with a potential customer. He looks at you and you look at him. You gulp a couple of times, smile to show your best set of china clippers, and say to yourself "What in the world do I do now?"

Well, basically, your job is to find things he needs, awaken his desire to buy, overcome any objections which might arise, and close the sale.

BUYING SIGNALS

Uncovering Need: In the initial conversation, watch closely for every sign of interest the potential customer shows in your products, or in the services you have available. These are called buying signals.

If, for instance, the prospect is already a customer in that he is in for a lubrication and oil change, check the car carefully while it is on the rack. If possible, do this while the customer is present. Ask him leading questions. Encourage him to talk. If you spot a leaky absorber ask him how his car rides, and how it holds the road on curves. Don't just point to the shock absorber and say, "It leaks. Want I should put on a new one?" Build up a case which automatically leads to new shock absorbers. Talk about stability, handling, safety, tire wear, etc.—all the areas where good shock absorbers are necessary.

Be careful not to run down the customer's car. Convince him that it's a darn good model. One of the best that Durant ever built. Agree with him that there are plenty of miles left in the old buggy—if it had new shock absorbers.

Handled properly, many customers tend to sell themselves. In many instances they talk themselves into buying replacement parts or needed service, but they want a little professional assurance that it's the best thing to do. You're the expert. Tell them so. Let them know that by buying a new set of shock aborbers—from you—they're protecting their investment, saving money, and providing safer, more comfortable transportation for their families.

If they waver, but still won't buy, offer a trade-in for the old shock absorbers, or maybe a discount on the installation. Cover these in the price of the new shocks, if possible. If not, it's still better to be building up a trade via lower prices than it is to turn away work; then sit around and listen to the overhead grow.

When customers patronize your lubrication department, they are in one of the best selling positions you'll probably ever find. Keep accurate records. Put in writing the mileage at which each individual car will need a new oil filter, or motor tune-up. Sell these things when they're needed. Be timely. Show consideration. Help the customer maintain his car properly.

One of the best ways to make sure that all items are inspected in an orderly fashion is to work from a prepared check-list. You can make up such lists yourself; but excellent ones can be obtained through suppliers and manufacturers, who are very cooperative, and supply all sorts of literature free of charge.

If you have employees, make sure each man is familiar with your check-list, and uses it regularly.

Part VII—Uncovering Needs—Awakening Desires

Used faithfully, the list can help uncover a vast amount of needed repairs or replacements. The difficulty will not be in locating needs for attention, but in **selling** the indicated service. As incentive, figure the potential profit on each sale. Accessory items, for example, usually carry about a 40 per cent mark-up. This alone is inducement enough to inspire vigorous sales effort on your part. Perhaps a commission on sales will also stimulate your employees into uncovering customer needs.

Awakening Buying Desire: After uncovering the need, you must follow through and awaken the customer's desire to buy. This isn't easy, because it's going to cost him money.

Most customers lack imagination. You'll have to work on all customers using the same technique as earlier explained in selling shock absorbers—that is, sell benefits, not products. Your technique will vary as much as customer habit patterns vary. Each person buys for different reasons. It's up to you, as a salesman, to size up each customer quickly, decide which sales attack will work best, then hammer away along this line.

The basic reason for anyone buying anything, or doing anything, is explained as motivation. Its entirely possible that the biggest percentage of the general population do not themselves understand what makes them buy. Tell a customer his muffler is leaking and he'll probably shrug his shoulders. But tell him how much power and gasoline he's wasting, or relate a true story about a recent death due to carbon monoxide poisoning, or ask him has he noticed headaches develop after a short time behind the wheel, and you'll improve greatly your chances of selling a replacement muffler. Customers won't buy a piece of metal to go under the car, but they will buy power, economy, safety and energy. It follows, then, that this is what you must sell.

You must think about motives in every sale. Uncover the **need**, then awaken the **desire** to buy. This is the old **one-two** of making sales.

If you have two cars in your shop at the same time and both of them need mufflers, it's very unlikely you'll be able to sell both owners by using the same sales approach. One man might be a tight-fisted old gentleman who really watches his pennies. The other could be a young single fellow who would rather spend his money for the necessities of life like wine, women and song. Placing both these men in the same group is a sure way to miss at least one sale or maybe both. They are different. They think differently, live differently, and buy for different reasons.

The older man might buy the muffler because it's cheaper to buy it now than wait until he gets a ticket from the police for violating a noise ordinance. Maybe he's lived to his ripe old age because he's safety conscious. He might buy because it's detrimental to his health not to buy. Another reason could be that he'd be embarrassed if his neighbors thought he had hot-rod mufflers on his car, or if they might think he's too cheap to keep his car in good working order.

The younger fellow might not give a hoot about what his neighbors think. Deadly fumes? So what, he likes to live dangerously. City ordinances? Ha. Ha. Laws were made to be broken. Save gas? Well, that's a point. It would leave more money for beer. More power? Could use that. Have to shift into second to get over a pedestrian.

Form a subconscious habit of thinking about each product or service in terms of buying motives. What are all the reasons anyone might think of for buying each one? What kind of person would be moved by one or more of these reasons? Record these reasons on a sheet of paper. Write the name of the product or the service at the top of the page. Itemize motives, or reasons for buying, at the left in a column. Opposite each, list the type of person most likely to respond to this motivation. You

Simple, but effective selling by demonstration: "That's how much resistance you should have," the shopman tells his customer in a comparison of new and used shocks. (Photo courtesy, The Gabriel Co.)

might add a third column to list what you could say or do in each case—a cue line to get you into your selling act. This isn't hard to do. It can be interesting and rewarding.

Definitely, it's not a spectator sport. If you read about it, find it interesting, then forget it, you've gained very little. You must **act** to get **results.** Start today to make written analysis charts of every product or service you could sell. Do this even if you're working for someone else. After carefully analyzing buying motives and types of customers, think up selling phrases, or sentences that will sell. Think about what kind of supporting evidence you can use to back up your story. Be careful not to depend upon a lot of "tired" advertising jargon; be as sincere as you know how. Put your own arguments in your own words.

Study product information closely. Dream up several convincing demonstrations that you might use. Nothing corny. Just simple, visual, down-to-earth selling demonstrations.

Personal appearance is one good key to the customer's personality, which, in turn, indicates his general buying habits. For instance, if you spot a man carrying an umbrella on a clear day, he's suspect for the conservative, super-cautious buying pattern. This kind of man may buy electric windshield defrosters in July, or maybe a gadget that automatically keeps his battery electrolyte up to recommended levels at all times.

General attire is another tip-off to buying habits. A well-dressed man whose clothes appear to be expensively tailored, but not in the latest style, apparently buys quality for the long pull. Your best line of merchandise is probably what he's looking for; and he expects to pay premium prices for premium goods.

On the other hand, a loudly dressed individual, who keeps abreast of all styling changes might be just the one who will buy the latest accessory items, like jazzy hood ornaments, bubble-type fender skirts or tricky side view mirrors.

By intelligent personal evaluation, precise use of supporting evidence, and by dramatizing benefits and consequences, you can sell. You won't find it necessary to employ high-pressure tactics. The high-pressure will come from the customer when you accelerate his motivational engine, and add fuel to the inner fire of his desires. By practicing good sales techniques, you can make your customers want your products and services more than they want their money. When the customer has this feeling, he'll buy without thinking he's been over-sold. After buying from you, he must leave your shop feeling you did him a big favor by showing him how to increase his safety, protect his family, add to his dignity, increase convenience and comfort, save money, etc. These are the things you will have sold, not products.

Plan your daily work routine to (1) uncover customer needs, (2) awaken the desire to buy, and (3) make the sale.

All the while you are doing this, of course, you'll be watching closely for buying signals. If a customer looks at a display, that's a signal. If he asks about a product, a price, or a service, that's a signal. If he picks up a can of stop leak from your shelf, that's a signal. If he complains about his car, that, too, is a buying signal.

Conversational buying signals can best be handled by the "feedback" method. This is a device used by experienced salesmen to agree with the customer and build his comments into a sale.

For instance:

Customer: "My steering seems a little loose. The car wanders all over the road."

Feedback: "I know what you mean. Drives me crazy when a car does that. It's dangerous, too, etc."

Customer: "My engine sounds a little noisy, and it idles rough."

Feedback: "I noticed that when you drove in. Doesn't sound too bad, but you don't want it to get any worse. By fixing now we can save you a big repair bill."

Customer: "Tire prices seem to be getting higher all the time. I've been waiting months for them to come down."

Feedback: "That's true. They've been going up for years—just like everything else. Of course, the tires are getting better all the time, too. Buying new tires today can save you time and money later on. Make your car a lot safer for your family."

These are all ways in which you can use the feedback technique to turn a complaint into a sale.

Selling can be fun and profitable if you learn the rules and follow them to the best advantage. It's certainly the highest paid job in the world. It's also indispensable in the future for continuing success of any independent repair shop.

Happy is the man who makes that sale! His satisfaction—and the customer's—in a job well done is often as important as the financial return to the shop. (Photo courtesy of McCord Corp.)

Regional rust pattern indexed by 25-year research program

• WITHIN FOUR YEARS, uncoated 28-gauge steel will be rusted to a very severe degree in any major U.S. industrial center—This is one of the finding of an extensive study of steel corrosion, made by the Rust-Oleum Corp., Evanston, Ill., and included in the "Rust Index of the United States," just published by that firm.

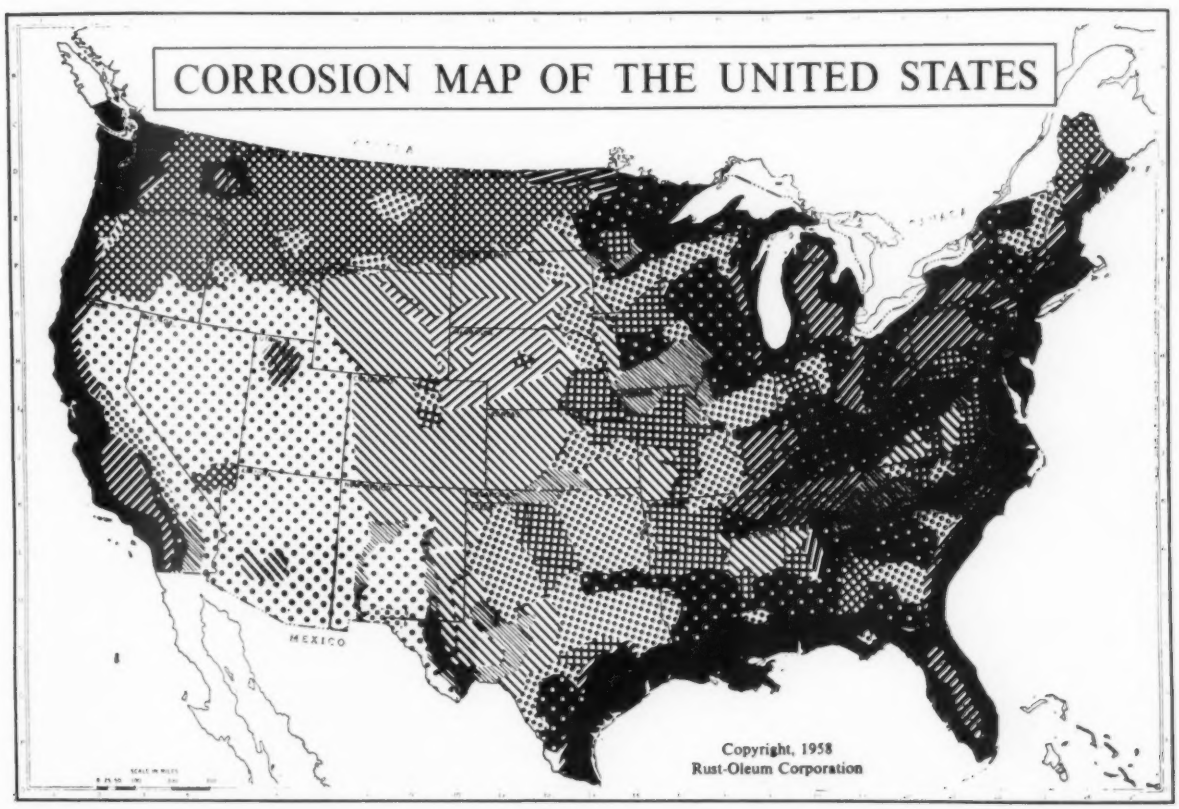
Compiling the results of 25 years of testing—during which thousands of low-carbon, cold-rolled, steel test panels, the size of a license plate, were allowed to remain exposed until corroded to the point of virtual uselessness—the Index covers the comparative rust rate for the 523 U.S. cities with populations of more than 10,000. Rainfall, corrosive gases, sunlight, salt water and wind are among the factors that cause rust variation.

It takes three years—fastest rate in the country—to "rust out" test panels in Buffalo and Rochester, N.Y.; Erie, Penna., and Miami, Fla.; while Tucson, Ariz., Roswell and Santa Fe, N.M., enjoy the slowest rust rate—15 years. The map below indicates the cross-country geographical pattern.

According to the company, the nation's current annual loss through rusting has a price tag of approximately $7½ billion—an increase of $2 billion over 10 years ago.

Of the 523 cities reported in the Index, 221—or 42 per cent—are grouped in "Class I"; which is composed of cities where the test panels "passed over the hump" rustwise, in less than four years. Every major industrial area, and most secondary industrial centers, are included in this "Class I" category. There are 95 cities in "Class II," denoting areas where rust life was between four and five years. These two classes, totalling 316 cities, make up 60 per cent of United States urban areas with population of more than 10,000.

Here are the "test scores" for some of the major industrial cities: Pittsburgh, three years and one month; Los Angeles, three years, two months; Cleveland, three and three; Chicago, three and five; Detroit and Philadelphia, three and eight; New York City, three and six; San Francisco, three and nine; Boston and St. Louis, three and ten.



Legend

The number of years and months required to corrode an uncoated 28-gauge steel test panel to a severe degree

YEARS AND MONTHS	COLOR CODE	YEARS AND MONTHS	COLOR CODE	YEARS AND MONTHS	COLOR CODE
3.00 – 3.11		6.00 – 6.11		9.00 – 9.11	
4.00 – 4.11		7.00 – 7.11		10.00 – 14.11	
5.00 – 5.11		8.00 – 8.11		15.00 +	

One-step valve guide seat reconditioning

By HERB CARRIER, Detroit Editor

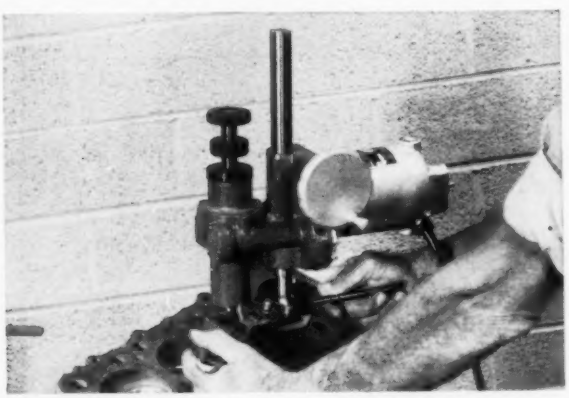
● PROPER ENGINE VALVE operation becomes a reality only when the valve stem guide bores are concentric with their respective valve seats. In many of the late model V-8 and in-line engines, integral valve guides are used, making a combination valve seat inserter and guide reaming machine desirable.

From the standpoint of a machining operation, an ideal condition is one wherein a worn valve stem guide is reconditioned and the head or block valve seat is counterbored in one basic operation.

With the equipment shown a worn valve guide is reconditioned either by reaming to fit an oversize valve stem, or core drilled for a sleeve machined to take standard sized stems.

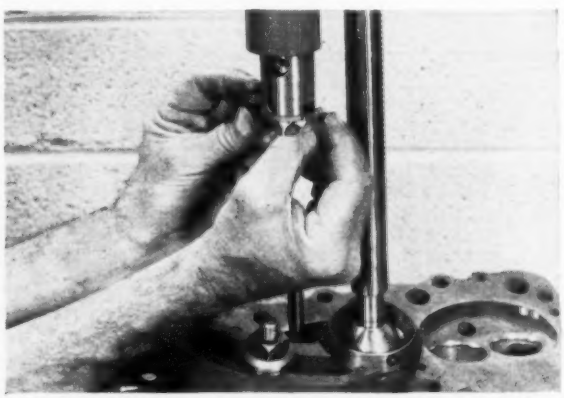
This photo report shows the progressive operations in reconditioning and integral valve stem guide, counterboring, replacement valve seat insertion and spinning the seat into a permanently locked position. More complete information can be obtained by circling No. 99 on the Reader Service Card in this issue. (*Illustrations, courtesy Hall-Toledo Co., Inc.*)

1. A specially designed pilot accurately centered in the valve stem guide. The valve guide and cylinder are cleaned of foreign material, burrs, etc. Wooden stand holds head in convenient working position and provides clearance between head and bench for the reamer.



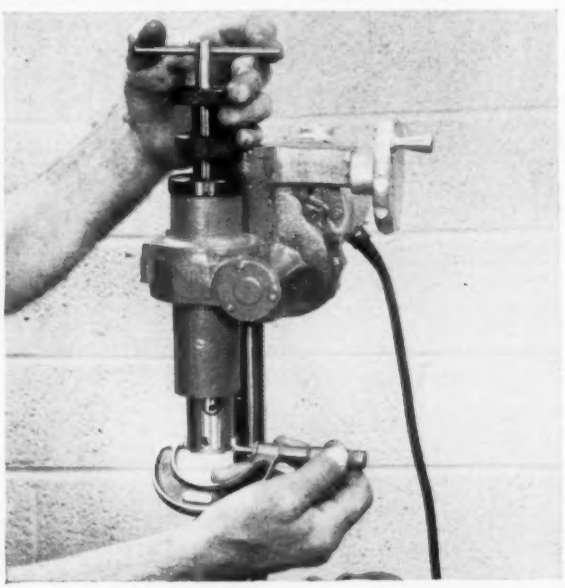
2. The machine's cutter head is centered over the pilot. In this position, the machine is securely mounted on the head. A ball and socket arrangement allows the machine to be lined up with any existing valve guide angle.

3. The outside diameter of the replacement valve seat is measured with a micrometer.

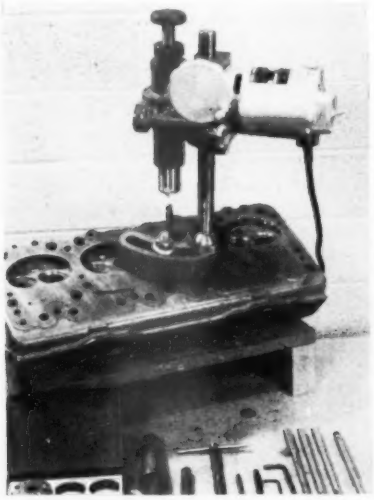


4. A pair of cutters are selected to go with the O.D. mike reading of the seat insert. Seven sets of cutters are available covering valve seats with O.D.'s of 7/8″ to 3-5/16″. An adjusting cone in the cutter head assures accurate mounting of cutters.

5. Cutting width is set with a micrometer. A press fit allowance chart, and an allowance for blade over-cut are considered when adjusting the cutters to width of replacement seat.

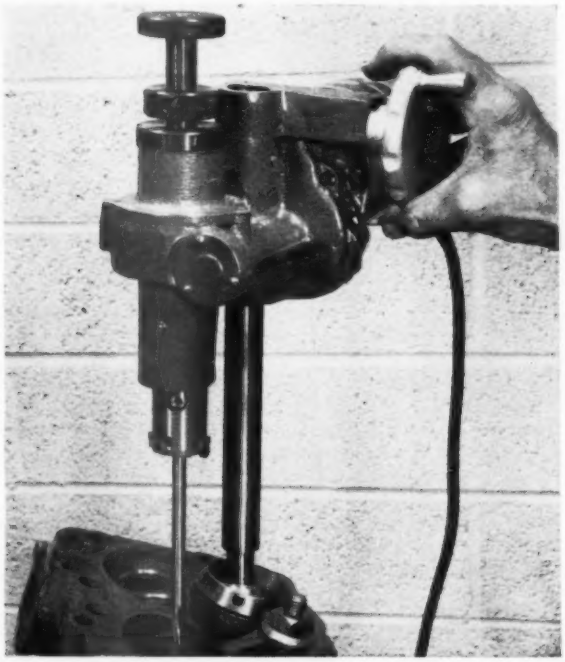


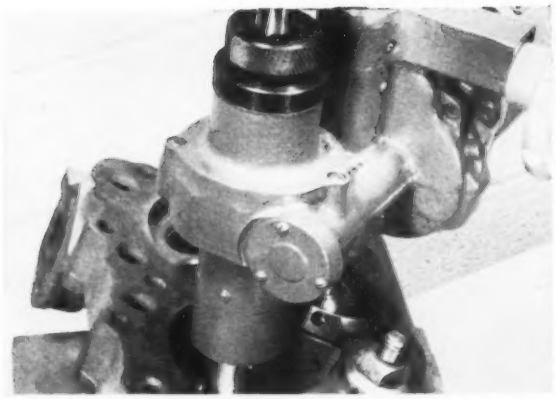
6. Cutting depth is set by placing replacement valve seat on machined surface of cutter head and running the threaded stop collar down until it contacts seat. The stop collar is locked in this position, and the seat is removed.



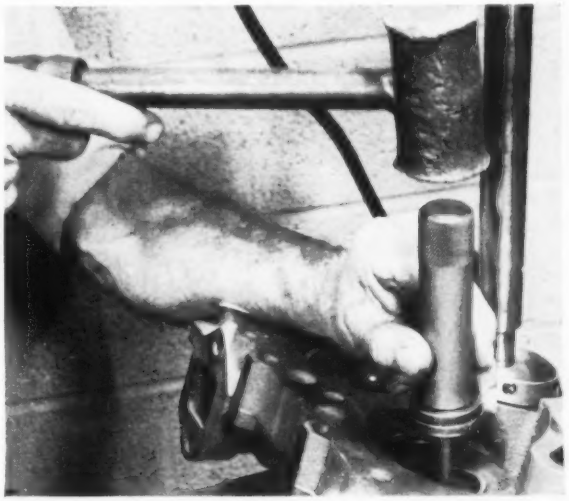
7. The correct size reamer is selected and inserted into the cutter head. The pilot is removed from the valve guide. Original alignment is maintained by removing the cutter head assembly from the ball shaft to install the reamer.

8. The reamer is hand fed through the valve guide. The "on-off" switch to control reamer rotation is located at the rear of the 1/3 hp. drive motor. Reamer is run completely through guide until cutters contact valve seat.





9. Cutter blades are hand fed into the valve seat until the stop collar bottoms. At this point the head is counterbored sufficiently to receive the replacement seat. Several revolutions are permitted after stop is contacted to clear the cutter blades.



10. The counterbore is completely cleaned of burrs and chips to insure full-contact seating. Then the replacement seat is driven into the counterbore. A suitable driver and a centering pilot are used to insure concentric installation of the seat.

11. A single spinning tool, mounted in the cutter head (cutter blades removed), can be used to spin cylinder head metal against the valve seat to securely lock it in position. For spinning, the seat is slightly chamfered before installation to permit head metal to be spun against the chamfer.

AUTOMOTIVE TECH KNOW-HOW

Starting balky engines

"My car won't start" is a frequently heard cry for help . . . and whether the car is out on the highway or inside the shop, the serviceman must be able to diagnose the trouble and prescribe a remedy accurately and quickly if the car owner is to be sent merrily on his way.

By GUY F. WETZEL
Technical Editor

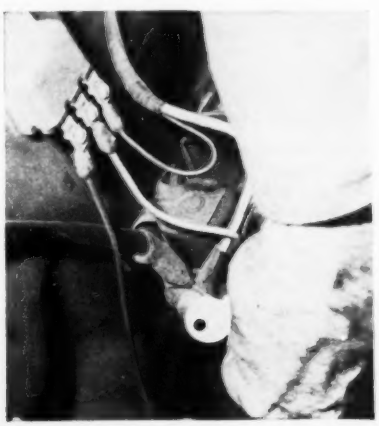
• ONE OF THE MOST frequent problems that come up from time to time is that of starting engines that apparently don't want to start. Frequently the car with engine trouble is out on the highway. Sometimes the car has been pushed or towed to the shop. Therefore, there are two sets of conditions or circumstances governing the working facilities available when such a job comes up. One is working with only the means at hand away from the shop; the other is working in the shop with the tools, equipment and test instruments readily available.

Out on the highway the job is to get the engine running if it is physically in condition to operate, even if not very satisfactorily or efficiently. Some testing instruments such as the voltmeter and dwell meter can be taken along in the car or truck that goes out on a starting-trouble job. If there are no instruments available the starting task may be a little more difficult and take more time. However, there is a testing and checking routine that will usually locate the trouble within a reasonable time.

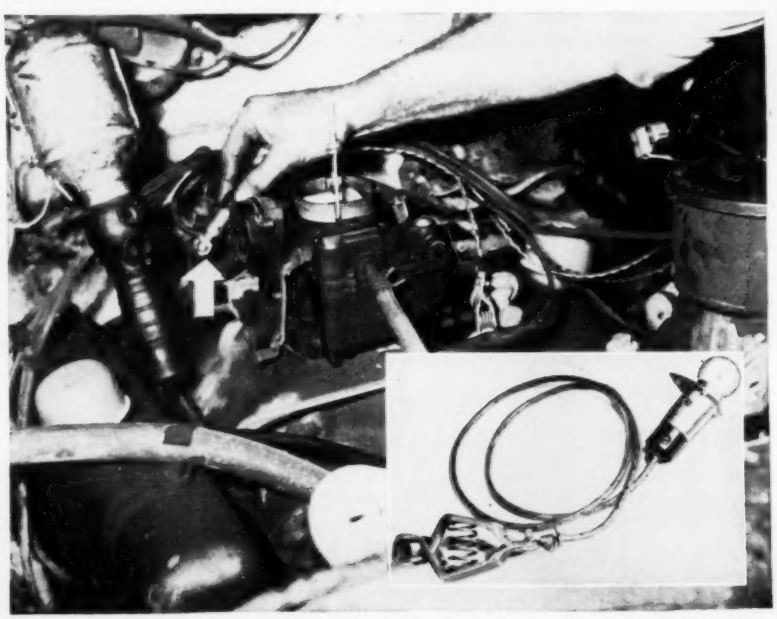
LOCALIZE THE TROUBLE

The three factors that are involved in engine operation are generally considered to be: (1) Ignition; (2) Compression; (3) Carburetion. In addition, there are two others that are quite important. These are: (4) Fuel Supply, and (5) Electrical Generating System. Defective operation of any one of these factors may prevent an engine from running, and occasionally there may be trouble with two or even three simultaneously.

The first step is to localize the trouble which made the engine stop if it had been running, or which prevents



In the absence of a remote control starter switch, a key, handle of pliers, or other conductor can be used to jump across the starting relay to operate the starting motor, where easily reached.



One of the very first things to do with an engine that won't start is to see if there is current up to the battery side of the coil. The handy, easy-to-make test light (inset) being used should be a part of every serviceman's "emergency kit."

the engine from starting. Many of the operations mentioned are well known and used by experienced servicemen; but some of the tests or checks will be new to some of the new-comers into the service field.

FIRST CHECK THE OBVIOUS

- Be sure the ignition current is turned on.
- Be sure there is enough fuel in the gas tank to operate the engine.
- Check lubrication to see that there is oil in the oil pan.
- Check to see if the engine is overheated, or out of water.
- Is the battery sufficiently charged to turn over the engine?

CHECKING THE BATTERY

If the battery has too low a state of charge it may not be able to operate the starter and at the same time have sufficient voltage to give a spark that is intense enough to enable the engine to start; especially on cars with six-volt systems. It is well known that when the starting load is applied to the battery the battery voltage will drop. If the battery should be half or more discharged, especially if spark plugs are in poor condition or there is resistance in the ignition system higher than normal, there is quite likely to be starting trouble.

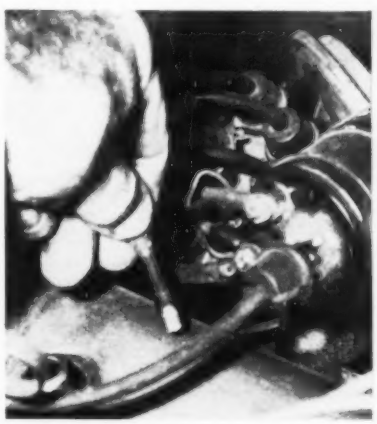
If the man on the starting job has a voltmeter with him, a good quick check of the battery is to operate the starter for fifteen seconds with the voltmeter connected across the battery. If the battery voltage drops below 4.8 volts or 9.6 volts on six-volt and twelve-volt systems, respectively, the charge is lower than it should be or the battery condition may be questionable. A hydrometer can be used to check battery condition if one is on hand. In the absence of instruments just listening to the starter operating and considering the speed with which it turns will give an idea of whether the battery is sufficiently charged.

JUMPING STARTER SWITCH

To operate the starter, always have a remote starter control handy. But suppose the cranking motor does not operate when the dash starter switch is closed, or when the remote control button is pushed. The remote control is connected from the hot terminal at the starter switch to the relay contact to which the dash starter control is connected. In case a remote control is not available the motor can be operated by using a key, wire, screw driver blade or handle of a pair of pliers to make the connection. This is easy on the starting systems using a simple relay to operate a Bendix cranking motor drive. On Delco-Remy motors, with the relay, solenoid and switch mounted on top of the motor, it may not be very easy to make the contact, though the remote control can be connected either from under the car, or, in some cases, by reaching down into the engine compartment.

A quick check of whether or not there is current up to starter switch can be made with a test light by grounding the clip and touching the prod to the point which should be "hot." If it is "hot", the light will light. If we get current up to the switch but not on the other side of the switch, it shows that the switch is defective. A heavy jumper cable should be on hand, and used to jump the switch to make the starter operate. If there is current at the motor side of the switch, and still the motor does not operate, it indicates trouble in the starting motor. In this case, the best procedure is to push the car to start it, and drive it to the shop.

If the battery is dead or so far discharged that it will not turn over the starter, the battery in the service car can be used with jumper cables to get a stalled motor running. If the generating system is functioning and the battery is in reasonably good condition there will be enough charge put into the battery to give one or two additional starts and to carry the ignition and lighting load. In a case of this kind the battery should be charged at the earliest opportunity. Also it is quite important to find out *why* the battery became discharged, and correct the cause so the same thing will not happen again.



To check for a spark, the wire from the center of the coil should be held 3/16" away from grounded metal and the starter operated. A spark indicates that ignition system is working up to coil tower; though this is not conclusive, as a weak coil can give a spark.

Where trouble in the starting system is indicated, always check for loose or high resistance connections in either the insulated cable or the ground cable.

Another way to check for spark is to hold a spark plug wire 3/16" away from grounded metal and operate the starter. Here the mechanic has inserted a key into the rubber spark plug boot to give metal contact.

To check for a defective distributor rotor, hold the coil wire close to the rotor while starter is operating. If a spark jumps to the rotor, it is defective; if not, it is OK.

IS THERE A SPARK?

A quick, though not conclusive test to see whether or not there is a spark is to pull off one of the spark plug wires or the wire from the center of the distributor cap (if it is long enough), hold the end of the wire about 3/16" from any good ground, and operate the starter with the ignition turned on. There should be a good, healthy looking spark jumping from the end of the wire. If the spark plug wire has a rubber boot over the end, insert a key, paper clip or piece of wire bent into a hair pin into the terminal so there will be metal projecting from the rubber boot and contacting the wire terminal inside. The

(Continued on following page)

spark, if any, will jump from this metal. If there is a spark, we can go on to the next test. If no spark can be obtained, the reason must be uncovered. This will be discussed later.

IS THE ENGINE GETTING FUEL?

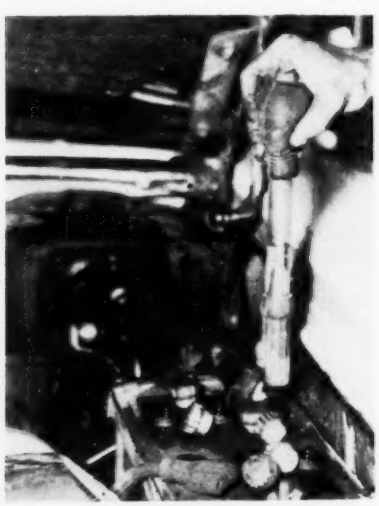
A simple way to see if there is gasoline in the carburetor is to remove the air cleaner and look down into the throat. If the engine is cold it will be necessary to open the choke butterfly, unless the choke is in the open position. This could be the cause of not starting when cold.

Moving the throttle linkage with a pumping motion should cause gasoline to squirt from the accelerating pump discharge nozzle. If gas does appear you can assume that the fuel system is working. If there is any doubt about the fuel system, check the flow of gasoline from the fuel pump by disconnecting the fuel line from the carburetor, and operate the starter for a few seconds. There should be a discharge of about a teaspoonful of fuel at each pump stroke. Catch the discharged fuel in a can, a piece of cotton waste or a rag; don't let it strike the hot exhaust pipe.

TRACING IGNITION SYSTEM TROUBLES

If there is no spark when a spark plug wire is held near a good ground, some checks and tests will have to be made to try to locate the trouble. A test-light, similar to the one illustrated at the beginning of the article, is handy for checking that there is current up to the battery side of the coil. Then test for current at the distributor side of the coil. The lamp will light when the distributor breaker points open and go out when the points close, if current is getting through the coil primary. If the engine is turned over with the starter, and primary current is flowing in the normal manner, the test-light connected to the distributor side of the coil or the distributor terminal will go on and off as the points open and close. It is a good idea to have a twelve-volt lamp bulb in the test-light as this will glow somewhat dimly when used with six-volt current and will not burn out when used with twelve-volt current.

Don't overlook the obvious . . . a discharged battery. A hydrometer check of all cells will indicate the state of charge.



Inspect distributor breaker points for condition and gap. Too small a dwell angle could keep the engine from starting.

If there is current up to the battery side of the coil, yet the lamp does not light when contacting the distributor side of the coil or the distributor terminal when the points are open or when the engine is being turned with the starter, then: (1) the condenser is shorted; (2) the points are not opening, due to excessive wear on the breaker arm rubbing block, or the distributor cam is not turning; (3) the coil primary is open; or (4) distributor pigtail is shorted.

If the test lamp lights when contacting the distributor side of the coil or the distributor terminal and does not go off and on when the engine is turned over by the starter, then: (1) the points are not making contact when they close; (2) there is bad distributor ground; or (3) the grounding pigtail in the distributor is open.

CHECK POINT GAP

If the points are not making contact about all that can be done out on the road, is to space them correctly and clean them with a file or a Flexstone (preferably the latter) in order to get sufficient spark to allow the engine to fire. Every service man should be able by inspection to set the points within plus or minus .001", so even if a dwell meter is not available the points can be set to a working gap. In the shop, new points should be installed if the old ones test out bad or by inspection are found to be worn out.

A wet ignition system may cause an engine to go dead. A heavy rain, splashing through a deep puddle, or even parking in a damp location when the humidity is high, may short out the high tension ignition current. Using a dry cloth to wipe off the distributor cap inside and out, the top of the coil and the exposed portions of the spark plug ceramic insulators will ordinarily permit the engine to start.

SHORTED CONDENSER

A shorted condenser will prevent an engine from firing, so if the other tests seem to indicate that there is a short in the primary system, the condenser should be checked. To do this, separate the distributor breaker points by inserting a piece of paper (a piece of a match holder will do) between them. Remove the condenser hold-down screw and lift the condenser clear of the distributor. Then with the ignition ON and all other electrical loads off, scratch the condenser body against the distributor housing. If a spark appears when the two parts touch, or if the ammeter (if there is one) jumps to show discharge, the condenser is defective. If the car has a radio, the engine can be started by removing the static-suppressing condenser from the generator and using it as a temporary replacement for the defective one. Ground it on the engine near the distributor if it will not go in the distributor, and connect its pigtail wire to the primary terminal.

In case there is no current to the

Removing air cleaner and looking down carburetor throat while pumping throttle linkage will show whether fuel is getting into the carburetor.

Holding your hand over the carburetor throat while turning the engine with starter (throttle closed) will sometimes remove a speck of dirt or water that may be the trouble-maker.

battery side of the coil, yet the battery is found to have a workable charge, run a jumper from the battery to the battery side of the coil, or the battery side of the ballast resistor on twelve-volt systems. Be sure this jumper does not go to the distributor side or there will be "fire-works" and probably burned points. The service car should always carry jumpers with clips on both ends.

HT TROUBLE SPOTS

In the secondary or high tension circuit there could be several sources of trouble, such as: (1) a bad coil; (2) bad HT conductors, corroded coil or distributor cap terminals causing high resistance in the circuit; (3) defective distributor rotor; or (4) defective distributor cap.

Locating a defective coil without a coil tester is rather difficult, except by elimination. If all other factors check out, try another coil which is known to be good. It is advisable to carry a couple of tested coils in the service car.

Sometimes a coil will have partially shorted secondary or primary turns in the windings which will decrease the coil capacity enough so that when the battery voltage is reduced because of the starting current draw, low battery charge, or high resistance in one of the circuits, it will not give enough HT voltage to get a suitable ignition spark. By pushing the car, eliminating the starter electrical load, a weak coil will sometimes start the engine.

Bad HT conductors may cause sufficient cross-firing to make starting difficult. Out on the road if it is seen that sparks jump from one wire to another, the wires can usually be separated enough to correct this temporarily on most cars until new wires can be installed.

Every once in a while the distributor rotor will develop an electrical leak which will ground out the HT ignition current. This can be tested by removing the distributor cap, and pulling the coil wire out of the distributor cap center tower. Hold the wire about 3/16" away from the center of the distributor rotor and turn the engine over with the starter, with ignition turned ON. Nothing should happen if the rotor is good. If it is bad, a spark will jump from the end of the wire to the rotor, grounded through the rotor to the distributor shaft. If this is the case the only remedy is to put in a new rotor. If one is not at hand, the only remedy is either to go to the nearest source of supply to get a new one or push the car to the shop. It is always advisable to carry an extra rotor, just in case!

The distributor cap occasionally develops cracks or grounds which will interfere with ignition. Usually the sparks can be seen if the crack is on the outside, and often the spark can be heard jumping on the inside. Carefully wiping the inside and outside of the cap will often make it usable, especially if the trouble was due to a film of moisture or oil.

TRACING FUEL SYSTEM TROUBLES

The first thing is to see if there is gasoline in the fuel tank. The service car should always carry a can with at least two gallons of fuel, preferably Ethyl, since so many engines now require premium fuel, and all engines will run on it.

The various fuel system troubles that can cause an engine to stop on the road and refuse to start are: (1) dirt or water in the carburetor; (2) flooding of carburetor; (3) clogged or restricted fuel filter; (4) faulty fuel pump; (5) clogged air vent at fuel tank; (6) flattened or kinked fuel line; (7) leaking flex line; (8) inoperative automatic choke; (9) vapor lock; (10) leaky gas line fittings on suction side of pump; (11) badly clogged dry-type air cleaner or filter.

Dirt or water in the carburetor will be indicated if the engine has been sputtering. Try cupping your hand over the carburetor throat while the cranking motor is operating. This puts added vacuum on the float chamber and nozzles and may dislodge a clogging speck of water of dirt.

Persistent flooding and stalling may be caused by a stuck choke butterfly. Check the butterfly by seeing if it moves easily and note the position of it. Clear out the flooded carburetor, intake manifold and engine cylinders by operating the starter with the throttle wide open—do not pump it! Flooding can also be caused by a sticking float needle valve. Tapping often helps this.

If the fuel filter is restricted or clogged, unscrew the clamp knob under the glass bowl and pour out any sediment or water. If the ceramic filter

(Continued on following page)

A sure test of the fuel supply system can be made with this fuel pressure and delivery tester. It catches the amount of fuel delivered in 30 seconds and also indicates fuel pump pressure.

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appears to be dirty, replace the bowl without it and tighten the knob securely. The bowl should be at least partly filled with fuel when the engine is turned over. On some of the Oldsmobiles and other GM cars, remove the paper filter disc on top of the ceramic filter. This disc sometimes gets clogged up and will not allow fuel to get through in sufficient volume to run the engine.

Flattened or kinked fuel lines will restrict the flow of fuel. Squeezing with pliers on the widest section of the flattened part will open it enough to allow fuel to get through. In the shop it is best to cut out the flat part and put in a new piece of tubing.

AIR LEAKS

A leaking flex-line will allow air to get into the system on the suction side of the pump, which reduces or stops the flow of fuel from the tank to the pump. The safe remedy is to replace the flex-line. In an emergency, cleaning the ends and winding with friction tape, preferably the plastic type, will usually get the engine going until a new line can be obtained.

An inoperative automatic choke will keep a cold engine from starting. If this is the case, the choke can be worked by hand to get the engine going.

If the fuel pump proves to be faulty, this could be due to excessively worn linkage, a ruptured or leaking diaphragm, a broken spring, or defective pump valve. If the linkage is at fault, it is possible that removing the pump and installing it without the gasket between its flange and the engine block will increase the pumping stroke enough to get fuel to the carburetor and get the engine running. Tighten the screws around the diaphragm housing as it might be leaking air. If these suggestions do not work it will be necessary to push the car to a shop.

For every bit of fuel drawn from the fuel tank, air must be admitted to the tank through a vent. If the vent is closed or clogged so that air cannot get in, the flow of gasoline to the carburetor will soon be stopped. To check this, remove the gas-tank cap while listening carefully for the sound of air rushing in to fill the vacuum. If this is heard, replace the cap loosely to allow air to enter the tank; or if there is a vent hole in the cap, see that it is open.

VAPOR LOCK

Vapor lock will sometimes cause a hot engine that has been standing for a while to start with difficulty, or not at all. Vapor lock means that there is

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enough heat applied to all or part of the suction side of the fuel system to vaporize some of the fuel. The fuel pump's ability to handle gasoline vapor is very limited; therefore there will not be enough fuel getting to the engine to allow it to operate. The remedy is to either allow enough time for the system to cool down so the vaporized fuel can be recondensed, or cool the system with cold water or cool, wet cloths.

Leaky fittings in the fuel line on the suction side of the pump will allow air to get in the system and interfere with the drawing of fuel from the fuel tank to the pump. As part of the check of the fuel system it is a good idea to tighten all the fittings which can be reached.

The dry-type air filter or air cleaner is a potential source of trouble which can keep an engine from running and make it very difficult, if not impossible, to start. A number of cases have come to our attention where the paper filter element was clogged so solid with dirt that an electric lamp placed inside it would not show through. On the 1957-58 cars so equipped always keep in mind the possibility that these units may be the cause of trouble. The remedy, on the road, is to shake or jar out enough dirt to allow the engine to run, then replace at the earliest opportunity.

In the foregoing we have tried to cover the majority of causes for emergency road service. However, no discussion such as this could ever be 100% complete, but most of the troubles that will be encountered have been mentioned, so as to permit the serviceman to locate and correct troubles so the motorist can be on his way with the least delay.

Adjusting Turning Angle On 4-Wheel Drive Willys

Should inspection of any Willys 4-wheel drive vehicle determine that the turning angle of the front wheels is not correct, the turning angle should be changed to meet the specifications for the particular model being inspected.

The turning angle is limited by stop screws mounted on the rear of the axle housing near each front wheel. In the extreme wheel position, the stop screw head contacts the head of a steering knuckle oil seal felt retainer screw.

The stop screw is welded in position. To adjust the turning angle it is necessary to break the weld, adjust the screw to its new location, and reweld in place to prevent any movement of the screw.

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Instrument corner

Conducted by The Instrument Man in the interests of simpler, faster, more satisfactory—and more profitable—service operations.

● THE TABLES WERE TURNED on the Instrument Man recently, when he served as moderator at a symposium on Trouble Shooting, held by the Society of Automotive Testers. Well aware that "symposium" means a discussion carried on by a group on a subject of common interest, the Instrument Man knew he was—for once—in the position of asking, instead of answering the questions. His role was to present to the audience, questions that had been brought to the attention of the committee. They were the type that come up again and again in the service shop. The first:

If you failed to connect the generator armature wire to the voltage regulator, or if it broke or worked loose, so that the circuit was incomplete, would the generator be damaged when it operated? Assume that the generator is the standard, two-brush job, such as used on Chevrolet.

At first, the boys were a little diffident about giving their opinions, but the ice was quickly broken, and the discussion soon became quite lively. The consensus of opinion was that in the case of a generator connected according to the A-circuit, in which the field current is picked up from the insulated brush and is grounded through the voltage regulator, the field windings would be burned out and the regulator also would be damaged in a short time.

With the B-circuit, used on Ford products, the field current is sent to the generator **from** the regulator and grounded within the generator, or in some cases by means of a separate grounding wire from a connection on the generator. In this case, since the armature circuit was broken, and no current was sent to the regulator, there would be no field current and nothing would happen except that the generator would produce no charging current. This assumes that the wire is off while the engine is not running, and before starting it. If it comes off while the generator is charging, damage will result after prolonged operation.

Another question came up: *What damage will result from reversing the armature and field leads during installation of a generator?* The answer agreed on was that no damage would result.

The next question presented was: *What is the best way to connect up a radio on the 1958 Chevrolet so that it can be used with the engine not running and ignition turned off?*

After some discussion it was decided that the best way would be to disconnect the wire carrying current to the radio and run another wire of ample size from the battery side of the starting motor solenoid to the radio, to supply power, being sure to insert a fuse in the circuit near the solenoid connection to protect the circuit and the radio instrument.

WHY INSTRUMENT CORNER?

Because we know the help he's given so many shops first-hand is just as valuable in the re-telling as it was in the happening, we've asked The Instrument Man to pass along some of his more interesting experiences. As an old-timer in automotive servicing who is distinguished by the fact that he's kept up-to-the-minute on developments in his field, The Instrument Man gets many calls for help from friends, acquaintances and even strangers, in shops large and small. He generally solves the cases, because of his understanding and appreciation of trouble-shooting instruments.

INSTALLING AN AMMETER

Another question that often comes up in many shops is: *What is the best way to connect an ammeter into the car electrical system so that it will show both charge and discharge from the battery on cars where only a signal light is used to show when the generator is operating?*

There was considerable discussion on this. It was pointed out, among other things, that the ammeter of the type used on automobiles is not of test instrument accuracy. On the other hand, it does give fairly well informed drivers information as to what the generator is doing and whether the regulator is functioning approximately as it should.

Because of the heavy currents used to handle the electrical loads in late model cars, inserting an ammeter would require very heavy wire and would introduce an objectionable voltage drop, due to the length of leads required. It was also pointed out that it would be difficult to put an ammeter into the loop circuit used on some late model cars.

It was finally decided that if an owner wants an instrument on the dash to indicate what is going on as the generator operates, the best solution would be to furnish a small voltmeter with a lead connected to the wire running from the battery side of the starting motor relay and to ground, or to some other continuously live point, such as the B terminal on the generator regulator and to ground. This would indicate the system voltage. The instrument could be calibrated with a scale to show when the battery is furnishing the current and when the generator is supplying it.

An actual trouble case, was next submitted for discussion. A 1955 Ford V-8 had trouble starting. Sometimes the starter would operate; at other times nothing would happen when the starting switch was closed. Battery, coil, points and condenser, fuel pump, and spark plugs, were replaced. A valve job and a new cable were tried. With all the new parts and the valve job the engine would only start sometimes; at other times, the starter would only turn the engine very slowly. A number of fast charges were given to both the old battery and the new one. Still no improvement.

What should have been done in the way of testing or changing parts that was not done?

It was agreed that the only proper way to proceed in a case of this kind is to start a series of tests to see where

the defect is located. The idea of a program of changing parts blindly, hoping to hit the defective part by luck, is expensive for a customer and time-wasting for the operator, and frequently loses the customer altogether.

These tests should be made, according to the group: Battery gravity test and capacity test, starter draw test, battery cable voltage drop tests, and voltage drop across the solenoid. These should reveal the trouble, though in cases of intermittent trouble like this, it may be necessary to make the tests while the trouble is actually occurring.

On cars with automatic transmissions, neutral safety switches should be tested, as sometimes they will cause trouble by introducing high resistance, or opening the ignition circuit. Some cars are also equipped with relays and vacuum switches which could cause the condition mentioned in the problem.

Where the starter relay grounds through the generator, a dirty or burned generator commutator or sticky brushes can sometimes cause this intermittent starting failure.

The actual cause of the trouble on this car was a defective starting switch. Apparently the contacts in the switch were burned or dirty, so that sometimes there would be a good contact, sometimes a partial contact and at other times, no contact. A new switch corrected the difficulty.

"HOME MECHANIC" GETS IN TROUBLE

Another problem case was described to the group: A 1955 Ford V-8 was pushed into a shop. Its owner, a young man to whom a "little knowledge is a dangerous thing," had decided to put in new points and condenser himself and save the cost of having it done. He removed the distributor without noticing the position of the rotor, and in the process of pulling the distributor, pulled four wires out of the distributor cap—a mere trifle! He put the points and condenser in the distributor, spaced with a thickness gauge and put the distributor back in the engine. He stuck wires back where he thought they belonged. Then when he tried to start the engine, it backfired and bucked. After running the battery down trying to start it, he finally gave up and had one of his pals push the car to a near-by shop.

The shop operator was told what had happened and was given the job of getting the engine running again. The ignition timing was entirely off, and four wires were in the wrong places in the distributor cap. So he went at the task of putting the distributor in place correctly, so No. 1 cylinder would fire at the proper time. He removed No. 1 spark plug, turned over the engine, and by noting the air blowing out of the cylinder was able to tell when the piston was on the compression stroke. Then getting the timing mark right at the pointer, he knew that the cylinder was in firing position. By connecting a test light from the distributor terminal to ground, he was able to tell when the points just opened to break the ignition circuit, since the test light lit up at that time. By moving the distributor very slightly back and forth, the light could be made to come on and go off. This indicated that the engine was in time very closely, but the problem of getting the wires in the right places remained.

The high tension wires on this car were held tightly in two clamps on each side so that they could not be pulled to see which distributor wire-end belonged to which spark plug wire-end. Both the test light and voltmeter were used to try to trace the wires by putting the test light clips from the hot battery terminal to the spark plug end of the plug wire and grounding the other end of the plug wire. A couple of the wires were traced in this way, but there were ap-

(*Continued on page 75*)

Editorial Feature in this issue . . .

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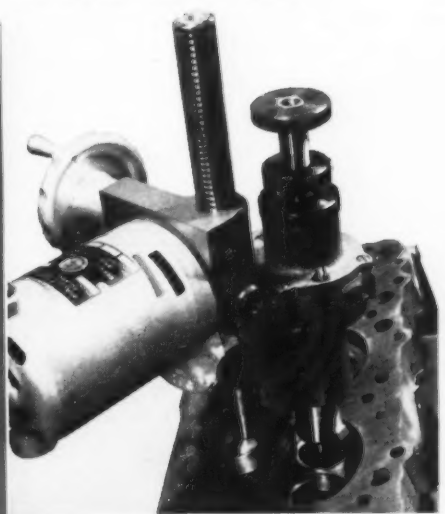

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Servicing air conditioners

With the increasing number of cars being air-conditioned for passenger comfort, a profitable business of installing, testing and servicing the units awaits the shopman who understands how and what makes them work.

Part VI—Servicing Rambler Units

By ED PACKER
Member, S.A.E.

• THE AMERICAN MOTORS air conditioning system is a complete, all-season set-up. The refrigerating action is provided by the evaporator core installed in the housing just back of the engine on the firewall at E in Fig. 1. The heater unit is at the opposite side of the housing in the area indicated by H. Air circulation for cooling or heating is by a rotary or squirrel cage type of blower in the round housing W and driven by the electric motor P.

All units of the heating and cooling system, other than the manual controls, are located under the hood. The compressor N is driven by belt in the conventional manner through the magnetic clutch-type pulley M.

Forward of the radiator is the condenser C, and at its right side is the receiver and filter (R). Immediately back of the filter is the sight glass and above the filter and attached to it is the check valve. These are the essential units of the refrigerating part of this all-season air conditioning system.

The heater is quite conventional, the core being provided with hot water from the engine through the lines (L) in Fig. 2. Heat for the interior of the car is controlled by a manual lever on the dash acting on a thermostatically-actuated water valve (V), Fig. 2. All controls for ventilating, heating, and cooling, as well as defrosting, are grouped on the instrument panel at the left of the steering column.

Refrigerating action of the Rambler all-season air conditioning system is designed to maintain the temperature within the car at 15-20° lower than that outside, when the vehicle is going 30 mph. The system is rated at a capacity of 1½ tons at 30 mph—which in the popular language of the air conditioning trade, makes it an 18,000 B.T.U. installation.

Its panel controls consist of two levers, one regulating the cowl ventilator and the other the water valve; and two knobs, one of which controls the fan and the heat damper, the other the defroster. The fan knob is pushed in to energize the magnetic clutch and drive the compressor and rotated to set the fan speed—counterclockwise, for high, clockwise for low. When the ventilator lever is pushed upward to its topmost position, the cowl vent is closed and no outside air enters the car; in any lower position, a proportionate amount of air is admitted.

Quite commonly, the defroster knob is pushed inward, to the operating setting, when the car is in motion with the cooling system at work.

While we are primarily concerned with mechanical service or maintenance of this unit, here is an operating idea that improves the circulation of the cooled air.

The cool air is discharged into the car from registers at the top left and right of the instrument panel. Each register has a door hinged along its rear edge. Opening the door only partially directs the cool air into the front seat area. This setting is generally preferred for maximum effect when only the front seat is occupied or when the car is being driven into the sun. Setting the discharge registers wide open is best for overall front and rear cooling.

The sun visors also get into the act. When they are in the full up position, the air circulates most readily toward the rear. Tilting the visors down redirects a large volume of the cooled air toward the front seat portion of

The Rambler air conditioner installation: C, condenser; E, evaporator; H, heater; M, magnetic clutch; N, compressor; P, blower motor; R, receiver; W, blower.

Fig. 2. Tightening heater line (L) to Rambler's thermostatic water valve (V).

the car. Understandably the visors are effective only when the air registers are wide open, so that the cool air shoots straight up to the visor area. Warm air displaced by the cool air moves around and under the seat, and is drawn into the inlet openings of the dash panel. The blower draws this air into the heater box. This recirculated air is intermixed by the blower with fresh air from the cowl vent, and redirected through the evaporator core where it is again cooled and once more circulated through the car interior.

In addition to the general tools that any good mechanic would own, there are several specialized tools and pieces of equipment necessary for air conditioning work. Since these have been described and pictured previously and are available either through your jobber or tool salesman, they are merely listed here as a reminder:

Leak detector
Test manifold with gages (Fig. 3)
Thermometer
Valve wrench (Fig. 3)

In addition, a cylinder of Freon-12 and a scale for weighing the amount of Freon-12 used will be needed, or the small Freon-12 containers will be used.

The detailed principals of refrigeration have been given earlier, and will not be repeated here. But in servicing the Rambler, or any other automotive air conditioner, keep in mind these fundamentals: A refrigerant in the system (generally Freon-12) must be compressed. Compression develops heat, which is released to the outside air as the high pressure refrigerant vapor passes through the condenser. In this action the vapor is converted to a high pressure liquid. The liquid then passes through suitable connections and is reduced in pressure, passing through an expansion valve into the evaporator where it acts on a greatly increased surface. As the liquid vaporizes or boils, the heat necessary for vaporization is extracted from the air, thus providing the desired cooling effect. This explains the relationship and function of the principal air conditioning units originally seen in Fig. 1. Now for the testing and servicing of these units.

COMPRESSOR

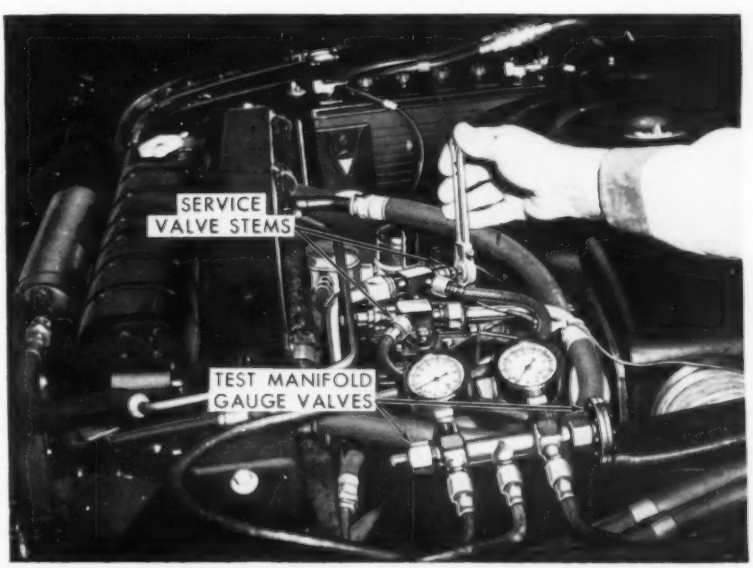
The two-cylinder reciprocating type compressor is driven by a "V" belt through a magnetically actuated clutch in the compressor pulley. Be sure to keep the compressor drive belts—both the one to the idler shaft and the one to the compressor—tight. Adjustment is by means of a slotted bracket on the idler shaft. Belt tension should be rechecked every 2000 miles. The compressor oil level should always be checked when the system has been opened for any reason. A full charge of oil in the compressor is 10 ounces. This will show as 1½ inches on the dipstick. A straight piece of clean wire will serve as your dipstick. If the level is down to 1⅛ inches on the stick, you have only 9 ounces which is a minimum for safe operation.

In normal operation a small amount of oil is always circulating with the Freon-12 throughout the entire refrigerating system. Unless the system develops a leak, the oil level in the compressor will remain unchanged. Therefore unless you are servicing the system as the result of a leak, you can take it for granted that your compressor oil level is okeh.

Since oil is distributed throughout the entire system, note the following closely when installing a new compressor. The oil charge in a new compressor is sufficient for an entire system. So without running the old compressor that is being replaced, check its oil level. Then check the oil level in the new compressor. Then add oil to or remove oil from the new unit until the level is the same as in the old compressor.

The hose connections to the compressor are long enough to allow the compressor to be removed from its mounting brackets and moved to one

Fig. 3. Two vital tools of this work: the service valve wrench and test manifold with gages (car shown is not in the AMC line).



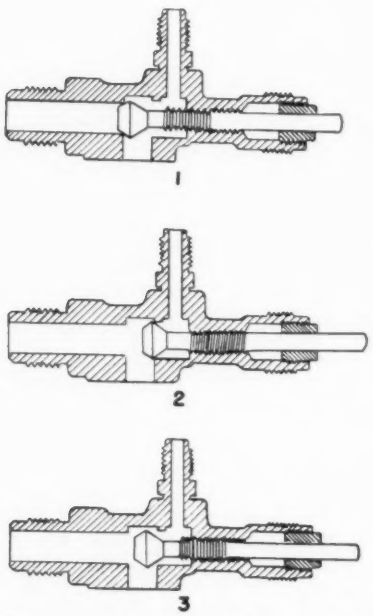


Fig. 4. Positions of the discharge service valve when (1) evacuating, (2) operating, (3) charging and operating with gage set.

side to permit various engine overhaul operations. Generally this removal of the compressor can be accomplished by loosening the drive belts and removing the bolts that hold the compressor to its mounting. In some cases it may be necessary to also remove the mounting brackets and possibly the idler or related parts, depending upon the service job being done on the engine.

If the compressor is being removed from the refrigerating system, as for replacement, the refrigerant will have to be discharged from the system.

COMPRESSOR TROUBLE SHOOTING

A good compressor develops both pressure and vacuum. You can get a pretty good idea of compressor condition by turning the compressor over by hand. Definite compression can be noted. At the top of the compression stroke, however, there should be no tendency of the flywheel to follow around. Following around indicates a discharge valve leak.

To make a more thorough test, attach a compound gage—the low pressure gage of your gage set—and close the compressor discharge service valve. Fig 4 is a schematic cross section of the discharge service valve. The three positions represented are as follows:

1. Evacuating
2. Operating
3. Charging and operating with gage set

With the engine idling, energize the magnetic clutch of the compressor pulley with battery current, and run the compressor for intermittent intervals of a few seconds duration, allowing the compressor to rest for a minute or so between. This will allow the Freon-12 to separate from the oil in the crankcase of the compressor, and will reduce crankcase pressure.

How quickly a compressor can pump a vacuum of 12 inches or 18 inches indicates its efficiency. A further test is to note how quickly the compressor can build up a pressure of 150 to 200 pounds on the gage (high pressure gage). Shut off as soon as 200 pounds is reached. If the pressure holds, the discharge valve is good.

SERVICING COMPRESSOR VALVES

American Motors provides a valve replacement kit for service. To replace or otherwise service the valves or valve plate assembly, discharge the refrigerant from the system. To discharge the system, attach the gage lines from the gage manifold set to the service valve connections. Close the compound or left gage of the set. Open the high pressure valve to the center connection.

Fig. 5 is a schematic diagram through the compressor showing the gages and how they are connected so as to discharge the refrigerant from the system. At the moment it is not the gages that are so important as the manifold and its valves.

It has been stressed earlier—but we will emphasize again—that whenever refrigerant is released from the system that it should be allowed to escape slowly. Goggles should be worn by the mechanic, and any line opened should be disconnected gradually to avoid the possibility of liquid refrigerant striking any part of the body, particularly the eyes. Freon-12 should be discharged only where there is good shop ventilation.

Aside from the possibility of personal injury from rapid release of the refrigerant (Freon-12), fast discharge is likely to carry away lubricating oil needed by the compressor. When there is no evidence of oil escaping with the refrigerant, the rate of discharge can be increased by opening the valve a little more. When the hiss of escaping Freon becomes inaudible, and gages show Zero, you know that the refrigerant is totally discharged.

The foregoing discharge procedure should be followed whenever any refrigerant-carrying component of the system is removed.

With the system discharged, remove the compressor cylinder head. Scrape off and discard the old gasket. Examine the cylinder walls and the tops of the pistons. The compressor needs to be replaced if there are any cylinder scores.

Fig. 6 identifies the parts involved in a valve service job, and the order in which they are in the compressor. On assembling, use new gaskets, and dip them in refrigerant oil before putting them in place. Also dip the valve leaves in clean refrigerant oil before assembling.

Install the suction valve leaves on pins on the bottom side of the new valve plate. The discharge valves are furnished installed on the valve plate. Install the valve plate gasket. Install the valve plate with suction valves in place on the compressor. Install cylinder head gaskets, cylinder head, and run the cylinder head bolts in finger tight. Torque them to 15-20 foot pounds. Check and adjust the oil level in the compressor, and charge the system with refrigerant.

The proper charge for the Rambler system is 3 pounds of Freon-12.

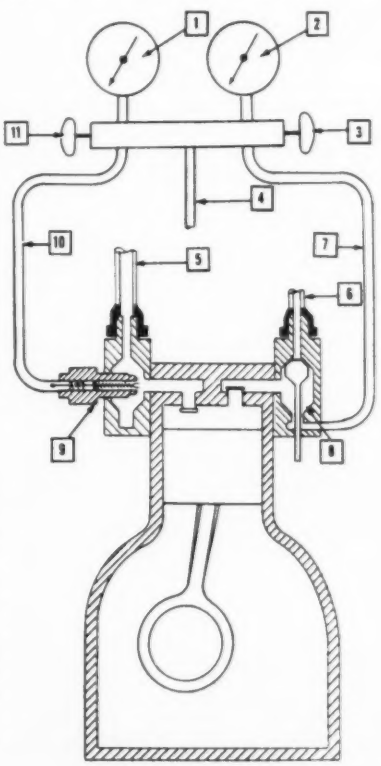


Fig. 5. Schematic for evacuating the air conditioning system: 1, compound gage; 2, high pressure gage; 3, high pressure gage hand valve in open position; 4, gage line, center connection, open to atmosphere; 5, suction line, evaporator to compressor; 6, discharge line, compressor to condenser; 7, gage line, high pressure gage to discharge service valve; 8, discharge service valve, closed position; 9, suction service valve opened automatically by quick coupler tool; 10, gage line, suction service valve to compound pressure gage; 11, compound pressure gage hand valve, closed position.

American Motors urges the addition of 2 cubic centimeters of methanol per pound of Freon-12. This is added to the compressor crankcase through the oil filler opening (provided it is not furnished in the Freon-12 you are using) while the system is still discharged. The methanol will work into the system in the same manner as the oil when the system is in normal operation.

Before installing a complete charge, the system should be given a partial charge and checked for leaks. The now familiar leak detector is "fired up" with about a $^3/_8$ inch flame, and the sampling tube brought into the vicinity of every part of the system where a leak might exist. This will include seals of the compressor, valves, lines and fittings, as well as all connections to or on the condenser and the evaporator.

When the sampling tube of the torch picks up Freon-12, the test flame will turn green. And the bigger the leak the darker will be the green. Extremely large leaks may turn the flame to a bright purple, or may even extinguish it by blocking off air and oxygen.

Avoid breathing the poisonous fumes and black smoke produced by the burner of the torch if Freon-12 gas is added to the flame.

When there is no evidence of leaks —any detected having been corrected —proceed with the recharging of the system.

PARTIAL RECHARGE

The sight glass installed in the liquid line is used to check the system for a normal charge. Bubbles of vapor seen passing through the sight glass would indicate a low or insufficient charge of retrigerant. Allow the system to run for a period of 5 to 10 minutes to normalize before checking the sight glass for vapor bubbles.

At the start of operation, some vapor is likely to appear in the glass especially on an extremely hot and humid day.

In a correctly charged system, the liquid level in the receiver covers the liquid outlet tube to prevent hot gas from going to the evaporator. The receiver is normally 50 to 60 per cent filled with liquid.

There is actually no way of determining how much refrigerant is required if the sight glass is checked and vapor bubbles are present. If one is in a hurry or lacks proper facilities it is common practice among many air conditioner mechanics to add sufficient refrigerant so that the bubbles just disappear. Then they add just a little bit more. But this is pure guess work.

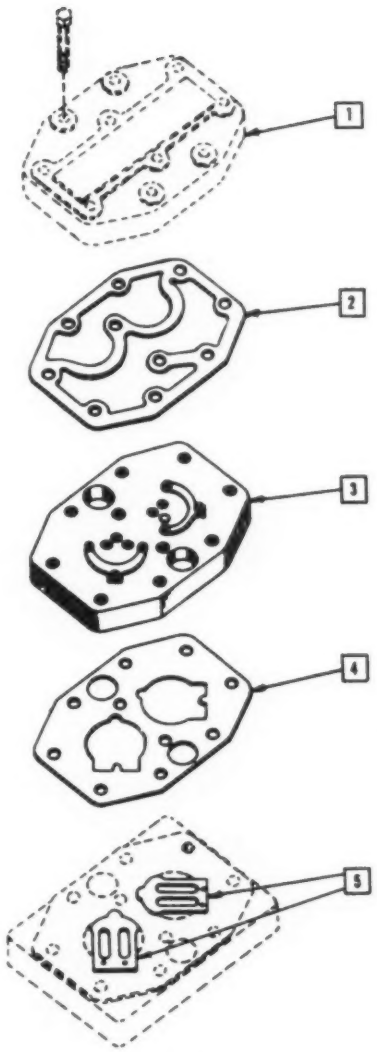


Fig. 6. Valve plate kit and assembly sequence: 1, cylinder head; 2, valve plate gasket; 3, valve plate assembly; 4, cylinder head gasket; 5, suction valve leaves.

To know how much refrigerant is introduced into the system, watch the changing weight of the drum as indicated on the scale.

Charging the system is done without running the compressor. The hand valve to the compound gage is closed. The discharge service valve is in the "cracked" position. Open the Freon-12 drum valve. Charging with liquid refrigerant on the high pressure side of the system as pictured means that the liquid refrigerant goes through the condenser and into the receiver.

The drum of refrigerant may be warmed by placing it in a bucket of warm water. The temperature, however, should never be above 125°F. And never use a torch or open flame to heat the drum.

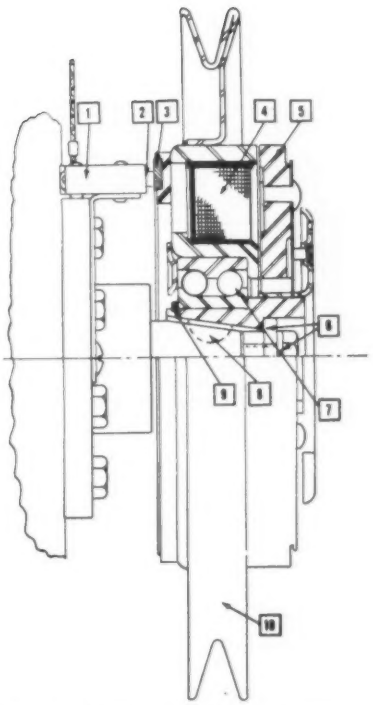


Fig. 7. Magnetic clutch and compressor pulley units: 1, bracket and brush holder; 2, contact brushes; 3, commutator or contact ring; 4, electromagnet; 5, clutch plate and facings; 6, clutch plate clamp washer and cap screw; 7, double row ball bearing; 8, Woodruff key; 9, pulley and electromagnet to clutch plate snap ring; 10, compressor pulley.

Warming the drum is particularly important when the system is being charged on the low or suction side. Then the charge must be in a vapor state. For this the drum is left in the upright position, allowing the vapor to be drawn into the system. For this procedure run compressor and pump refrigerant from drum into system.

The high pressure gage and valve is closed and the compound hand valve opened when charging with vapor on the suction side.

Operate the air conditioner at maximum output for a few minutes with the engine running at approximately 1500 rpm. Observe the sight glass, and the high and low pressure gages. Then run the engine from 10 to 15 minutes at idle to normalize the system. If no bubbles appear at the sight glass and the pressures are normal, your job is done. Note, however, that the head pressure (high side) should not exceed 275 pounds at normal room temperature of 70° to 80°F.

MOISTURE AND AIR

Presence of air and moisture in the system is harmful, and precautions

(Continued on following page)

should be taken to prevent both from entering the system. Moisture and air often enter together because all air contains water vapor along with the oxygen, nitrogen, and other gases of which it is composed. Moisture and air may enter through leaky shaft seals, faulty tubing connections, defective gasket joints, and other leaks. They can get in during service operations which are incorrectly performed and during installation of equipment. Water or moisture may enter with refrigerants or oil which has been allowed to gain water through contact with air. As a precaution, the compressor oil container should only be opened when in use.

WATER MAIN TROUBLE SOURCE

Water causes the most serious troubles. It does not dissolve in Freon-12; but separates and remains apart from the refrigerant. The separated water is likely to freeze into ice and clog the small openings in the expansion valve. Ice in the expansion valve orifice stops flow of refrigerant. Then the evaporator and valve warm up, the ice melts, and refrigeration once more takes place, only to be stopped again as more ice forms. Such intermittent refrigeration is an indication of water in the system. Clogging due to particles of dirt reduces or stops refrigeration completely until the dirt is removed.

The best insurance against moisture is to prevent it from entering the system.

This can be done by keeping all components sealed prior to installation and during repair procedures. Should the system be opened for a service operation, seal the openings and lines with plastic caps.

If the symptoms of water are present, corrections are necessary. Release the charge, evacuate the system, and recharge. Water will be evaporated during the evacuation process. Also, any air that may be pocketed in the system will be evacuated.

Air which consists of gases that cannot be condensed in the refrigeration system causes excessivly high pressures in the high side of the system and reduces the operating efficiency.

Install gage set and operate to determine pressures.

The presence of air is always indicated by high operating head pressure. (The pressure should normally not exceed 275 P.S.I. at normal room temperature.) This could be confused with an excessive amount of refrigerant which would also produce high head pressure.

No matter where or how air enters, it will always end up in the condenser, taking up valuable condensing space.

If the system is known to have the correct amount of refrigerant, but during operation and using the gage set, the head of high pressure builds up, air is certain to be in the system.

EVACUATING THE SYSTEM

The system should be evacuated every time it has been opened for a service operation, such as the replacement of a part or line. Air and moisture may have entered when it was opened. It is advisable to evacuate the system whenever a charge has been lost through a leak or loose connection. The system should be evacuated prior to charging if it has been standing for a period of time without a charge.

Using the compressor to evacuate the system the following procedure must be followed very carefully to prevent any damage to the compressor and its parts. Make certain the system is completely discharged. No Freon-12 gas should be present during this operation.

Install the gage set and lines to proper service valves on compressor.

The hand valve on the compound gage is closed to the center connection of the gage manifold set. The compound gage will still register low side pressure. The hand valve on the pres-

TABLE I

Outside Air Temperature	Temperature of Air Discharged into Car	Compressor Head Pressure	Compressor Suction Pressure
80°	42°	155 lbs.	20 lbs.
85°	47°	165 lbs.	20 lbs.
90°	52°	185 lbs.	20 lbs.

TABLE II

Gage Indication	Probable Trouble	Likely Correction
Low suction pressure	Low charge	Add charge
	Filter or screen plugged	Clean or replace
	Liquid line plugged	Replace
	Expansion valve super-heat setting too high	Replace valve
	Expansion valve thermo-bulb charge lost	Replace valve
	Expansion valve port plugged with dirt or moisture	Clean, eliminate moisture or replace valve
	Blower fan inoperative	Check motors and wiring
	Temperature control thermostat does not cut out	Replace thermostat
	Moisture or freeze-up	Open, evacuate, and recharge
	Expansion valve	Replace
High suction pressure	Leaky or broken compressor valves	Replace valves
	Clutch slipping	Check clutch and wiring
	Loose belts	Tighten
	Expansion valve	Replace
	Low charge	Add charge
Low head pressure	Leaky or broken compressor valves	Replace valves
High head pressure	Condenser air passages clogged	Clean
	Air in system	Purge
	Radiator fan belt slipping	Replace or tighten fan belt
	Excessive charge	Bleed excess
	Engine over-heating	Check cooling system
	Restriction in discharge line	Replace line
	Restriction on outlet lines of condenser	Clean or replace condenser
	Restriction in check valve	Clean or replace
	Restriction in receiver	Clean or replace
	Expansion valve super-heat setting too low	Replace valve
	Filter or screen plugged	Clean or replace

sure gage is open to the center connection.

The suction "Schrader" valve is automatically opened by the use of Quick Coupler Tool J-5420. The discharge service valve is "closed" by turning the valve stem in all the way. The discharge service valve gage port is open to the atmosphere through the open hand valve on the gage manifold set and the open gage line (Fig. 5).

The gages both should register "O" at this time as there is no pressure present in the system.

The discharge service valve being closed and with the gage port open, air pumped out by the compressor is exhausted through the open gage line attached to the center connection. With the discharge service valve closed, the system is closed off so that as the compressor pumps, the system is evacuated back to the closed valve.

Check the oil level in the compressor.

Start the engine and operate the compressor for a second or two, three or four times to reduce the internal pressure slowly. Then run continuously observing the compound gage. If the compressor is efficient, it should pump down from 12 inches to 18 inches vacuum, or higher, quickly. Do not run more than a few minutes as it is possible to damage the compressor.

If a 12 inch to 18 inch vacuum cannot be reached, the compressor valves are evidently defective or a leak is present in the system.

Details of the magnetic clutch and compressor pulley that drive the compressor are seen in Fig. 7.

The clutch is energized by battery current when the fan switch is in the refrigerating position, provided the thermostatically-operated switch in series with the magnetic clutch and controlled by evaporator temperature is functioning. This switch automatically remained in the closed position until the thermostat temperature drops to 41.5°F. Then this thermostatically-controlled switch automatically opens, stopping the refrigerating action until the temperature rises to 46.5°F. In this way the system is kept efficiently cold when operating, yet protected against freeze up of the evaporator core.

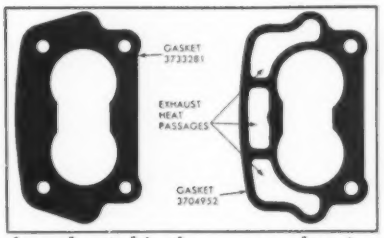
As a guide to the more likely types of refrigeration failure, standards of performance for the Rambler air conditioner at a car speed of 30 miles an hour are presented in table I.

Should the system that you are checking fail to meet the standards, the service diagnosis checklist in table II will help locate the trouble and suggest its probable cure.

Vacuum Spinner Governor Calls for Special Gasket

On all Chevrolet trucks equipped with 283 cu.in. V-8 engine, and using two-barrel carburetor with integral vacuum spinner type governor, it is essential to use gasket No. 3733281 between carburetor throttle flange and the intake manifold. If passenger car gasket No. 3704952 is used on these trucks, in error, exhaust heat will enter the carburetor through the gasket passages to cause early failure of the throttle valve shaft bearings.

All spinner governors have a small coil spring attached to the governor



lever located in the governor housing. To prolong the life of this spring, Chevrolet recommends that, at each carburetor overhaul, the governor housing side cover be removed and a small quantity of Lubri-plate be applied to the two spring posts.

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NEW CAR ANNOUNCEMENTS

Edsel

• THE 1959 EDSEL has retained the "Edsel look," but it has a completely new body, as compared to the 1958 models. In all three series: Ranger, Corsair and Station Wagon, the interior, dimensions, wheelbase, all stamped body parts, and the whole lineup of models have been changed.

Edsel's Ranger series includes a two-door and a four-door sedan, and a two-door and a four-door hardtop. Corsairs will be available in four-door sedans, two-door and four-door hardtops and convertibles.

In addition there will be two Villager station wagons—six-passenger and nine-passenger four-door models.

Specifically, the 1959 Edsel is five inches shorter in the Corsair series. The new line's 120″ wheelbase compares to 118 for the 1958 Ranger and 124 for the Corsair.

Three V-8, short-stroke, overhead valve engines are available. The Ranger V-8, displacing 292 cu.in. and producing about 200 hp., is standard on the Ranger. Standard for the Corsair series is the Express, a 332 cu.in. engine of about 225 hp. Optional for all Edsels is the Super Express, which has a displacement of 361 cu.in. and horsepower of over 300. A 145 hp. OHV six-cylinder engine is also available for the economy-minded.

All but the Super Express will operate efficiently on standard gasoline for more economical operation. Compression ratios—running from 8.4:1 to 9.6:1—have been revised on some of the engines to insure best combustion of standard octane fuel.

The engines feature high lift camshafts for improved low speed torque and more economical operation, hydraulic valve lifters (except on the Economy Six and Ranger V-8) and 18 mm. spark plugs with anti-erosion electrodes for peak efficiency and longer life. Carburetors have been redesigned for better operation and easier servicing.

Three transmissions, including Mile-O-Matic a new economy automatic transmission, are featured on the 1959 Edsels.

The new Mile-O-Matic uses a torque converter and planetary gears, and features a one-piece cast aluminum alloy integral converter housing and gear case. It weighs 50 pounds less than the conventional automatic transmission and contains 25 percent fewer parts. A dual range automatic and three-speed synchromesh transmission are also available.

A multiluber, which automatically lubricates the car with a push of a button on the instrument panel is an unusual option available this year.

Like the passenger cars, the 1959 Edsel station wagons have a completely new body. They offer increased load capacity and extend the loading area by 8.6 inches.

One of the outstanding features of the Villager wagons is the treatment of the third seat. The rear seat and back rest are light weight vinyl-covered foam rubber pads, which can be stored inside the car when extra load space is needed, and can do double duty outside as comfortable seats during picnics and other occasions.

1959 EDSEL ENGINE SPECIFICATIONS

	Economy Six	*Ranger V-8*	*Express*	*Super Express*
Displacement	223	292	332	361
Bore	3.62	3.75	4	4
Stroke	3.60	3.30	3.30	3.50
C.R.	8.4:1	8.8:1	8.9:1	9.6:1
Brake H.P.	145 (est)	200 (est)	225 (est)	303 (est)
Carburetion	1V	2V	2V	4V
Gasoline	Reg.	Reg.	Reg.	Premium

Imperial

• MORE ROOM FOR PASSENGERS and a more powerful, yet economical, engine are among the offerings of the 1959 Imperial. Other new and optional features include: A stainless steel roof creation for hardtop models, swivel front seats for convenience in entering or leaving the car, rear air suspension for maintaining level chassis under all load conditions, rear view mirror that electronically adjusts itself to avoid headlight glare, a new push- button controlled heater-air conditioning unit and an electronically controlled headlight beam changer. In addition, renewed emphasis is being placed on the Auto-Pilot turnpike cruise-control system which Imperial introduced on its '58 models.

NEW V-8 ENGINE

This year's Imperial has a new, more powerful engine which weighs approximately 100 pounds less than last year's model. It is a 90° V-8 with wedge-type combustion chambers and overhead in-line valve arrangement. Bore is 4.18″; stroke 3.75″. Piston displacement is 413 cu.in; compression ratio 10.1:1. It develops 350 brake horsepower at 4600 r.p.m.

Two stainless steel roof treatments are offered for the first time in two and four-door Southampton hardtops.

The Silvercrest-Landau roof design is a combination brushed, stainless steel metal applique which fits snugly over the entire roof area forward of the Landau roof step. It couples with a Landau rear roof design finished in a contrasting textured vinyl paint finish in a simulation of black, grained leather.

Individual Silvercrest stainless steel overlays or Landau treatments are also available in hardtop lines for those wishing to enhance the roofline of their Imperial sport models.

Ten models are offered; the Custom Imperial in a four-door sedan, two-door and four-door hardtop; the Imperial-Crown series in a four-door sedan, two-door and four-door hardtop, and convertible coupe, and The Imperial LeBaron series in a four-door sedan and a four-door hardtop.

A total of 21 paint finishes are available, all of them in a new super-enamel which is said to need no polishing for up to three years.

A bold new front-end appearance is dominated by a massive horizontal chrome bar with five dart-shaped vertical cross pieces. Twin dual headlamps are placed lower in the front-end, while the low-styled front bumper gives a feeling of forward thrust.

Lincoln

• THE 1959 LINCOLN amplifies its appeal by refinements of its already accepted classic appearance, and in improvements of its unitized design structure.

A new front grille is embellished with seven groups neatly stacked in concave-convex triangles that add to the feeling of width and lowness of the car. An extension of the grille curves into headlamp areas. The new bumper line is smooth and unbroken except for the depression in the center for license plates. Parking lights are recessed in the extreme ends of the bumper.

The 1959 Lincoln's appearance from the rear continues big and massive, but very appealing. Rear bumper and lower deck moulding form on oval shape to enclose a textured grille containing integrated running and stop lights at either end. The fuel filler opening is blended into the center of the grille.

The 1959 Lincoln power train includes such refinements as new engine mounts, a redesigned camshaft, a new spark curve on the distributor and revised carburetor calibrations to increase operational smoothness and eliminate vibration or noise.

A track bar extending from the left side of the underbody to the right end of the axle housing is used in con-

(Continued on following page)

1959 LINCOLN ENGINE SPECIFICATIONS

	1959	*1958*
Bore and Stroke	4.30 x 3.70	4.30 x 3.70
Engine Displacement	430	430
Compression Ratio	10.0 to 1	10.5 to 1
Crankcase Capacity w/o oil filter	5 qts.	5 qts.
Cooling System Capacity w/o heater	26 qts.	26 qts.
Horsepower	350@4400 rpm	375@4800 rpm
Torque	490@2800 rpm	490@3100 rpm

junction with four coil springs to eliminate vertical forces. In addition, six rubber bushings have been placed at the contact points between the rear suspension and the underbody to reduce road noise and vibration. To further reduce noise Fiberglass and asphalt-impregnated felt is strategically located to prevent the transmission of engine compartment murmurs to other areas of the car as well as the conventional spray-on fiber-impregnated mastic materials.

In keeping with Lincoln's dedication to precision design, a magnet attached to the fuel filter keeps out even the most minute metallic particles before they can cause damage to the engine.

A hot-cold air intake to the fuel induction system has been adopted to eliminate carburetor icing by maintaining a constant temperature range between 80° and 100° F.

While the car retains its same basic package size and roomy interiors, the overall length has been shortened two inches.

Major optional accessories include the following items: A single knob control air conditioning unit with five cooling outlets throughout the car; a special FM radio for static-free listening in any area; a six-way power seat; a power lubrication unit good for 240 applications; a direct power differential to eliminate slippage on ice, sand, mud or snow; power door locks; remote control deck lid lock; an automatic starter; tinted glass and special all leather trim.

Mercury

• MERCURY FOR 1959 is a big car. Overall length has been increased in Monterey and Montclair models to 217″, an increase of four inches. Width, at the center, front tread and rear tread each are increased one inch, and the overall height has been dropped an inch, to 55.7″.

Park lane models are 222″ long, an increase of four inches. They are an inch wider at the center pillar, 75.5″, and 56.2″ in overall height, a drop of one inch. Front tread is 60″, an increase of one inch, and rear tread is 62″, an increase of three inches.

This new car was developed deliberately to emphasize conclusively the transition which Mercury has completed from a "deluxe Ford" into an outstanding car in its own right. Both its chassis and its body are completely new, and its identifying styling characteristics have been developed to present a more streamlined appearance.

According to Ben D. Mills, general manager of M-E-L Division and a vice president of Ford Motor Co., "Mercury engineers and stylists have created a car that has these four characteristics:

1—Unequalled comfort for driver and passengers,
2—Distinctive, tasteful styling,
3—Outstanding quality and mechanical excellence,
4—Continued performance superiority.

A unique feature for 1959 is that two distinctly different styles of roofs are offered. The new "cruiser" roof for hardtop models has a sporty look with an unbroken flow from tip of the compound curved windshield to tip of the backlight. The new sedan roof is in direct contrast with its flat, crisp lines and its "cantilever" effect in the rear.

A major engineering change by Mercury chassis engineers has resulted in cutting almost in half the volume space taken up by the transmission hump and front compartment tunnel down the center of the car; thus increasing the leg room for those sitting in the middle of the front seat. The lowered tunnel also makes it possible to improve cushioning for passengers in the center portion of the seat. The tunnel reduction was obtained by moving the engine, transmission, and, therefore, the front wheels ahead to get them out of the passenger compartment. This is the basic reason for Mercury's longer wheelbase. In addition, more tilt was given the engine and transmission combination, which, along with the low entry position into the differential, meant a low drive line position fore and aft.

Entrance to both front and back seats has been improved by a new vertical windshield post which provides 2½″ more clearance for the knees getting in and out of the car. Entrance room is increased further by four-inch-wider front doors on four-door models.

A new two-piece die cast grille, bolted in the center, forms a wide span of rectangular segments, emphasizing the front end width. The bumper has recessed areas on each end for parking lights and recessed area in the center for license plate. A heavy rib section on the upper edge offers added strength to the bumper and reduces contact area subject to marring of chrome.

A new body and frame construction is part of the mechanical changes built into the 1959 Mercury. The frame is 15 pounds heavier and has been designed to give solidity to the car.

In the station wagons, the addition of a rear package locker located beneath the rear floor board makes a concealed storage compartment for cameras, parcels or tools or other items. Part of this compartment is used for completely folding away the third seat. The third seat is optional on all Mercury four-door wagons. The spare tire has been relocated in a vertical position behind the right hand wheel well.

The full line of Mercury engines includes 312 cu.in. displacement with two-barrel carburetor, 383 cu.in. displacement Marauder engines with two-barrel and four-barrel carburetors, and a 430 cu.in. Marauder engine with four-barrel carburetor.

Of special interest is the new economy Marauder engine which is designed to give superior fuel economy and smoothness of operation. It has 383 cu.in. displacement and a two-barrel carburetor.

Two series of automatic transmissions are offered for Mercury in 1959, the Merc-O-Matic single range, and the Multi-Drive Merc-O-Matic dual range.

Drivers and Shops Gain as Records Fall in Safety-Check

While new highs were set in the number of check lanes operated and the number of vehicles inspected, the 1958 National Vehicle Safety-Check campaign again found that one out of every five cars on the road are in need of maintenance attention. It was the fourth consecutive year in which the drive revealed 20% of operating cars to be in unsafe condition.

According to M. R. Darlington, Jr., Managing Director of the Inter-Industry Highway Safety Committee, this year's drive pointed-up the fact that most drivers are not aware of the condition of their cars. When shortcomings are brought to their attention, they act—because motorists recognize and accept the need to keep their vehicles in safe driving condition.

A report from San Francisco business participants highlighted the business gains to retail service outlets. In one case a driver bought three new tires, then returned to the community lane to pass the check . . . and another man bought a complete set of tires in order to qualify for the "Circle of Safety" windshield sticker.

Lima, Ohio, newspaper columnist Joe Conner wrote: "According to our information, one retailer racked up more than $400 in sales of mufflers, lights, windshield wipers and other items to motorists who failed to pass the check. And that was just the first day!"

One Safety-Check chairman received a letter of appreciation from a Seattle, Washington, motorist. This driver was told his emergency brake seemed to need adjustment; and taking it to his service shop, found the rear brakes in bad condition. He had the drums turned and relined—and thanked the committee for discovery of the condition before more damage had been done, increasing hazard and eventual costs.

Participating in the 1958 National Vehicle Safety-Check program were 2,065 communities—compared to 1300 in 1957—and the drivers of 3,070,495 cars and trucks, compared to 2,641,558 a year ago. Great Bend, Kansas, and Huntington County, Indiana, were named Grand Award winners for conducting the most outstanding city and county programs, respectively; and teenagers in San Leandro, Calif., won the new Grand Award for the most outstanding teen-sponsored drive.

Rear lights again led all other categories of the 10-point check in the need for immediate attention. The next most frequently found in need of immediate service were brakes, front lights, exhaust systems, tires—in that order. One motorist was grateful to be told that his rear lights had never been connected—on the car he had been driving for eight years.

Too Much As Bad As Too Little When Lubricating the Willys Jeep

You can kill some parts with kindness and starve others when greasing the Willys Jeep according to the company. The friction points in the clutch linkage on all models should be lubricated with oil every 1,000 miles. Failure to do so will cause the links to wear prematurely and the holes in the mating parts will become elongated.

However, "just a touch" per 1,000 miles is all that is required for the two lube fittings on the clutch cross shaft on model L6-226 engines. Excess grease may be forced into the flywheel housing and onto the clutch plates. Rear wheel bearings should also be lubricated with the miser's touch, taking care that the oil relief hole in the axle housing is kept clean. If these suggestions are not followed, surplus oil may saturate the brake linings.

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neither should it be frivolous and uninformative.

An advertisement can be interesting and humorous without being silly; constructively informative without being dry and technical; appeal to reason without being formidable; convey a complete story without becoming a long treatise. Here again, selection of the advertising technique should be governed by knowledge and consideration of many factors in the individual situation.

Question: How much detail work, and how much of a manpower load is generally involved for a shop that merchandises effectively? What can the owner or manager expect in terms of hours of work, added payroll cost, etc? Can you suggest shortcuts, practical economies?

Answer: Obviously, the answer to this question is entirely dependent upon the type and size of campaigns; how much is to be done internally and how much is to be done through outside organizations.

In almost every area there are addressing companies who will handle the addressing of direct mail; service printers who can be of great assistance in designing campaigns as well as printing the pieces; free-lance writers and artists. If an advertising agency is used, it can handle all or any part of the detail.

As stated elsewhere, manufacturers of tires, batteries, accessories and parts have complete programs and campaigns for dealers and service shops. These materials are available through the distributors or wholesalers, who in most cases are prepared and ready to assist service men in planning programs, securing the materials for them and helping conduct the campaign with a minimum of expense and effort.

Question: How should the management of an independent or dealer automotive service shop START planning for effective local merchandising? Can you outline a general step-by-step program, and offer a few "yardsticks" by which results can be judged as the work goes along?

Answer: A good first step in organizing an advertising program is for the service shop owner to meet with the salesmanager of a distributor or wholesaler, and decide upon the type and size of program that seems best suited to the dealer organization.

Once this decision has been made, the distributor's salesmanager can assist the shop operator to select the services and products to be featured and to set up a timetable of each step in the campaign.

Next the salesmanager can review with the shop owner the different materials available from various manufacturers whose products are to be featured, and arrange to secure the selected pieces.

The distributor salesmanager can also help in selecting a printer, addressing company and other outside suppliers that may be used in conducting the campaign. If newspaper, radio or TV are to be used, he will help in contacting the media and arranging details.

It is important that employees of the service shop be schooled to integrate their selling efforts with the advertising. The distributor can arrange for one or more meetings with the service organization, and secure competent speakers to cover the various phases of the program. Also the salesmanager can furnish information and assistance in setting up a sales incentive program in the shop.

The distributor salesmanager can also secure the right kind of signs, posters, merchandise displays and other materials for shop identification, and help get them properly placed at the shop.

The general effectiveness of the program can be gauged by the increase in sales and the number of new customers who come to the station; but the measurable results of advertising are dependent upon the type of campaign, timing and many variable factors. Some programs are designed to build confidence and prestige for the advertiser, while others are designed to induce people to come immediately to the store or shop for a special offer or sale. The result of the latter type of advertising is obviously more readily measurable. Coupons with redeemable value or premium offers are often used to measure the pulling power of an advertisement or direct-mail advertising piece.

The shop's merchandising success will be greatly influenced by the consistency and continuity of the campaign, the thoroughness with which the selling efforts, point-of-sale merchandising, sales incentives and follow-up activities are coordinated, and by the management and direction of all details of the program.

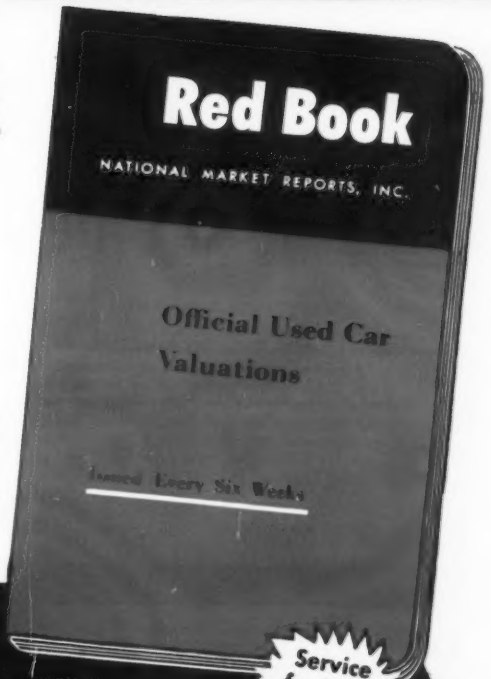
***

In the face of the facts as Martin Goldman so kindly puts them before us, there seems little excuse for a service shop to fail to merchandise effectively. Modern marketing is a true commercial science. Its laws are formulated and proved; its store of sales lore, vast and still growing fast. It has developed logistics that brings powerful sales aids to the doorstep of every automotive service outlet. In the battle of the marketplace, it has evolved realistic and successful strategies and tactics. They bring in business when used.

The alert and progressive service shop will take up the merchandising "arms" offered. By supporting these with the all-important technical know-how and equipment, the well managed shop is headed for a clean break-through on the profit front.

You Can Always Be Right

Get the FACTS Fast With

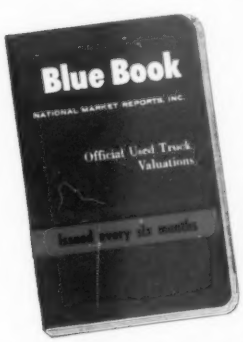


RED BOOK Official Used Car Valuations

Service for Year $8.00
Up-to-the-minute edition every six weeks covers prices in your trading area.

In every industry there is the final word in establishing values—how much to pay when you buy, how much to receive when you sell. For almost half a century the RED BOOK has been an indispensable part of the automobile industry — an authority wherever used cars were bought, sold, traded, or financed. The RED BOOK has been as dynamic as the industry itself—improving constantly year by year and so maintaining its dominant place.

- Takes guesswork out of valuations —every RED BOOK listing is authoritative.
- Designed for quick reference—use it once, and you'll always know where to look.
- Complete—and with essential features found only in the RED BOOK.
- Valuations on all passenger cars for the past nine years—trucks through 1½-ton capacity for eight years.
- Front view illustrations for fast identification.
- Title, license plate, sales and use tax data.
- Valuations include automatic transmissions except in low priced group.
- Reliable Finance Values—Wholesale Values — Realistic impartial Retail Values.
- Over 20 foreign cars listed in separate section.



BLUE BOOK

EXCLUSIVE TRUCK DATA AND VALUATIONS

Service for a year **$10.00**

Only service providing truck valuations and data for practically all makes regardless of tonnage. Valuations covering the past eight years are realistic, authentic. Data include model, motor and serial numbers, capacity, G.V.W., W.B., H.P. rating and factory prices. Published semi-annually.

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Please enter our order for the one-year services checked below, subject to your 30-day, money-back guarantee.

- ☐ Red Book Official Used Car Valuations Region A and B ..... $ 8.00
- ☐ Red Book Pacific Coast Edition Region "C" ..... $ 9.50
- ☐ National Auto Parts & Labor Manual, Domestic Cars, including year's revision service $18.00
- ☐ National Auto Parts and Labor Manual, Import Cars, including year's revision service $12.50
- ☐ Blue Book Official Truck Valuations $10.00
- ☐ National Tractor & Farm Implement Blue Book ..... $ 5.00
- ☐ Automotive Service Digest—Monthly— For a Full Year ..... $ 4.00
  - ☐ (In combination with any other service) ..... $ 3.50
- ☐ Check enclosed for $_____ (Quantity Rates on Request)
- ☐ Send C.O.D. (Plus Charges) *Rates for United States only.

FIRM NAME _____

ADDRESS _____

CITY _____

INDICATE: ☐ NEW CAR OR ☐ TRUCK DEALER _____ (MAKE)

OR OTHER LINE OF BUSINESS _____ RBA

These are new *manufacturers' products*

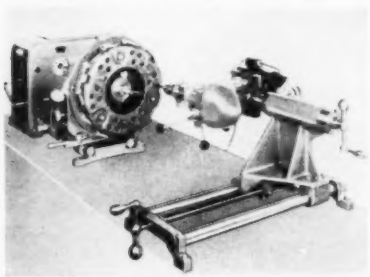
HOW TO GET RUSH INFORMATION

If you want further information or literature describing the products shown in our "These Are New" pages, just use the handy Business Reply Card you'll find further back in this issue. Whether you want information on one or more of the products, all that is necessary is to mail this Postage paid card properly filled out to AUTOMOTIVE SERVICE DIGEST. Our Reader's Service Dept. will contact the manufacturers directly and see that you obtain the requested information as quickly as possible.

Clutch Balancing Machine

A new clutch balancing machine, featuring accuracy and speed, has been announced by the Bear Manufacturing Co.

The clutches are mounted on master



adapter plates which are jig bored for accuracy with a quick acting split nut holding the clutches on hardened and ground pins during the balancing operation.

A precision dial indicator registers the exact amount of unbalance while a strobe light is used to indicate the position. When drilling for correction of unbalance, a special backing plate is used for locking out the pick-up mechanism. The entire procedure is said to be so simple, that all shop personnel can be trained in the proper operation of the unit in a few minutes.

(Circle No. 1 on Reader Service Card)

Enamel Reducer

A new automotive enamel reducer that is said to provide dependable control of spraying enamel in spite of adverse weather conditions, including cold and dampness, has been announced by the Ditzler Color Division, Pittsburgh Plate Glass Co.

To be known as Ditzco Bobcat Reducer, the product is said to provide smooth, even flow out, and perfect leveling. Particularly effective on metallic colors, the new reducer provides uniform distribution of metallic particles for quicker, more accurate color matching.

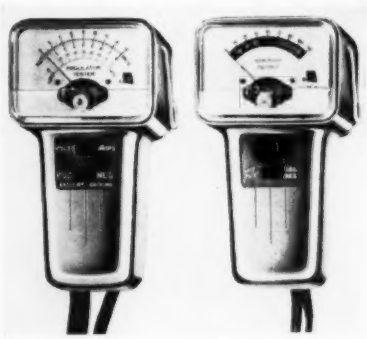
Another advantage is that the product may be used under a complete range of air pressures with easy handling with either the double coat method or the tack and flow coat method of spraying.

(Circle No. 2 on Reader Service Card)

Hand-Size Test Instruments

New to the Hanson line of hand-size test instruments are a simplified amp-volt, generator-regulator tester, and an ignition output tester, both equipped with a $3\frac{3}{8}$" x $2\frac{3}{8}$" color-coded dial.

The amp-volt, generator-regulator



tester (left) was specially designed as a single unit for quick, simple testing of generator output and regulator control as cause for discharged battery. It operates off 6- or 12-volt car batteries and features a special circuit that automatically inserts ¼ Ohm resistance in series with battery when testing.

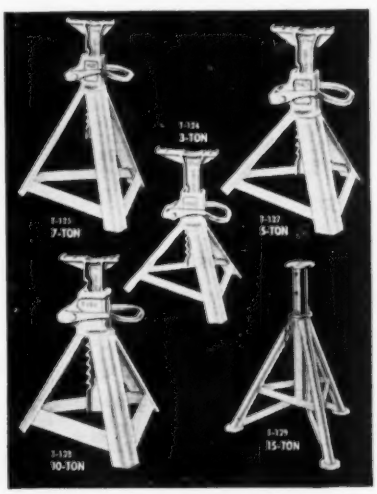
The ignition output tester (right) is so designed, even your customers can read and understand the condition of ignition systems. Simply clamping color-coded leads to spark plug wire and ground shows overall condition of 6- or 12-volt systems. The unit operates on two pen light batteries, making it ideal for road testing. It is also handy for pinpointing shorts in ignition harness and for determining condition of circuits; as well as for checking resistance of secondary coil.

(Circle No. 3 on Reader Service Card)

Axle Stands

The Ken-Tool Mfg. Co. announces a new Axle Stand, featuring high stability and extra-heavy construction. The complete line includes five models, from 3- to 15-ton capacity.

To prevent rocking and provide firm



support, even where floors are uneven or sloping, these supports are designed with three legs instead of the conventional four. Like a surveyor's transit, the Ken-Tool Axle Stand is self-adjusting to any floor contour and requires no special shimming or leveling.

Other safety features include: a) a self-locking mechanism to prevent accidental release while the stand is loaded; b) "Sure-Grip" saddle design to keep loads from slipping; and c) large base dimensions to minimize tipping.

With load off, the main support releases instantly in response to a slight lift of the balanced handle.

(Circle No. 4 on Reader Service Card)

Spray Motor Cleaner

Kleen-Off Spray Motor Cleaner, a new product of Heet Div., DeMert & Dougherty, Inc., research is said to quickly and safely remove grime, grease, oil and dirt from all types of motors . . . including automobiles, power mowers, trucks, stationery, diesel and marine engines, etc.

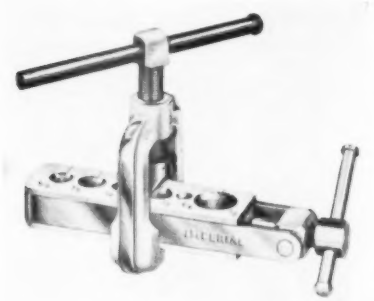
Packaged in a 16 ounce aerosol container, the spray is released through the top of the spray-head by simply pressing finger to side of valve (with can held in the position of a water hose) which allows for easy reach to hard-to-get-at surfaces, and more sufficient spray coverage and penetration. To use: simply spray on . . . hose off with water . . . and dirt, grime and grease are said to disappear.

(Circle No. 5 on Reader Service Card)

Tube Flaring Tool

A new 45° flaring tool that is said to provide faster, practically foolproof operation and assure accurate flare sizes, every time, has been announced by The Imperial Brass Mfg. Co.

Features of the new tool, called the "Hi-Duty 300-F," are: A chevron gripping action (to end continuous indentations around the circumference of the tubing that could set up stress points and cause flare weakness); self-gaging for flare size which automatically forms a flare with the correct SAE dimensions every time; high strength flare radius to assure stronger flares with a smooth even radius at the base, with original wall thickness maintained, and hard chrome finished cone, which is said to make smoother, finer flares with less torque required.



Flares on six different tube sizes—3/16", ¼", 5/16", ⅜", ½" and ⅝" O.D.—can be made with the tool. Heat treated sliding dies on die holder are easy to use, and the tubing is securely held by means of single lever clamping.

(Circle No. 6 on Reader Service Card)

Brake Fluid Dispenser

The Automotive Division of Wagner Electric Corp. announces a new brake fluid dispenser to be marketed as a special offer with its recently announced heavy-duty brake fluid.

The new dispenser saves the shopman time and effort, since it can readily be mounted on a one-gallon can.

With the dispenser mounted, a single stroke of the handle pumps enough fluid for a normal brake fluid replenishment. A fitting on the application side of the hose allows fluid to be dispensed by holding the handle and retracting the small ball next to the handle, allowing passage of fluid. Then fluid can be dispensed with fingertip control without waste or contamination. When the ball is released it seals the line, and the dispenser is in immediate readiness for its next use. No capping or "pouring back" is necessary. The hose is easily wrapped around the container, and the bracket includes a convenient holder for the hose.

(Circle No. 7 on Reader Service Card)

Ignition Parts Cabinet

Efficient stock control and fast-moving parts selection are said to be two of the many advantages offered by the new Service Parts Cabinet with clear vision doors being offered by The Electric Auto-Lite Co.

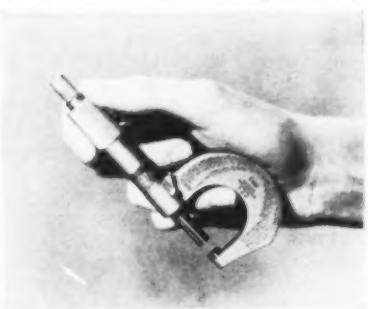
Available to dealers through their Auto-Lite source of supply, this cabinet has been specially developed for the small service dealer. Tailored in construction to accommodate fast moving service parts in an orderly fashion, the cabinet is of welded steel construction measuring 25" wide, 8" deep and 8" high. The locking, clear vision doors of the new cabinet make it an attractive merchandiser of electrical parts and service. While the cabinet fits on standard shelving, it is also key-hole slotted for easy wall mounting.

(Circle No. 8 on Reader Service Card)

Johansson Swedish Micrometers

The line of precision micrometers manufactured by the Swedish tool-making firm, C. E. Johansson Gage Co., originators and manufacturers of the famous Johansson gage blocks, is now being marketed exclusively in this country by the MG Tool Co.

Compact and light in weight, Johansson micrometers are available in .001" and .0001" graduations and each can be had either with carbide tipped spindle and anvil, or high carbon steel, as desired. A distinguished feature is their solid bronze inner sleeve which is said to eliminate friction between spindle and sleeve, resulting in smoother operation as well as longer life.



Threads of these micrometers are hardened, ground and lapped to ultra-fine tolerances, with guaranteed maximum pitch error of .00004" and maximum error per inch of .00008". All measuring faces are lapped perfectly flat, parallel to one another and at right angles to the axis, by the same method used in making Johansson gage blocks.

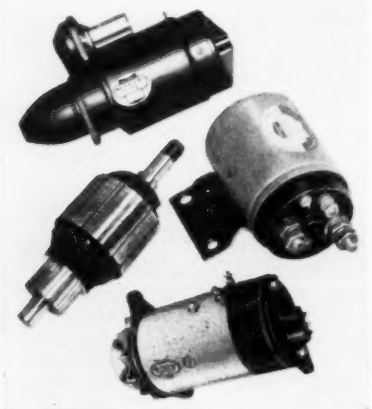
Other features include: dull chrome finish with deep black graduations, friction slip rather than ratchet for sensitive feel, simple adjustment for zero setting and for picking up slack, simple one-finger locking device and season tempered steel forgings.

(Circle No. 9 on Reader Service Card)

These are new *manufacturers' products*

Factory Rebuilt Units

Completely rebuilt starters, generators, armatures and solenoids for late model, 12-volt systems (including 1958) are now available from the



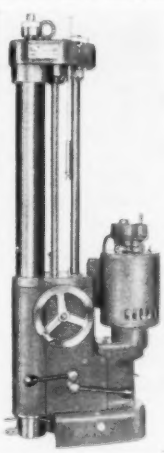
Arrow Armatures Co. Each is an original equipment unit, standard in every detail and capable of handling the full load requirements of 12-volt systems.

They have all been disassembled at the Arrow factory, and every component part cleaned and tested, with all faulty parts replaced. After reassembly, each unit must pass rigid tests simulating conditions said to be more severe than those encountered in actual service.

(Circle No. 10 on Reader Service Card)

Cylinder Boring Machine

Cedar Rapids Engineering Co. announces the addition of a new Model "FL" Cylinder Boring Machine to its line of Kwik-Way engine reconditioning equipment.



The latest model has a capacity of 3″ to 6¾″, and cylinders larger than 6¾″ can be bored through use of special equipment. Stroke is 18″.

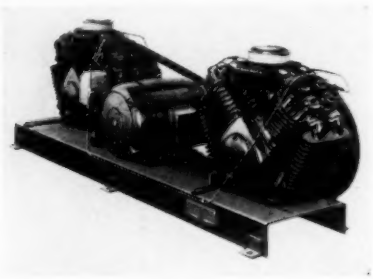
An important feature of the Model "FL" is the number of speed/feed combinations available. Four speeds and four feeds result in 16 different combinations, allowing selection of the proper spindle speed and feed for any given job. The machine operates to extremely close limits for taper and out-of-roundness and is said to produce round straight cylinders with extremely high finish.

(Circle No. 11 on Reader Service Card)

Air Compressors

To meet the demand for more air for spray painting and for operation of air tools in shops today, The DeVilbiss Co. has announced two new 20 and 25 horsepower, 125 and 175 pound air compressors.

Of double compressor design, the units will displace from 96.4 to 129



feet of air per minute, and are equipped with pressure switch and magnetically controlled unloaders. A magnetic starter with selector switch for automatic start-stop operation or constant speed unloading is available, as are vertical air receivers for remote installation.

The vee-type multiple-cylinder compressors have a bore in the first stage of 4½″, and 2½″ in the second stage; stroke is 4″. Compressor length is 88″, height 28⅜″ and width 28″.

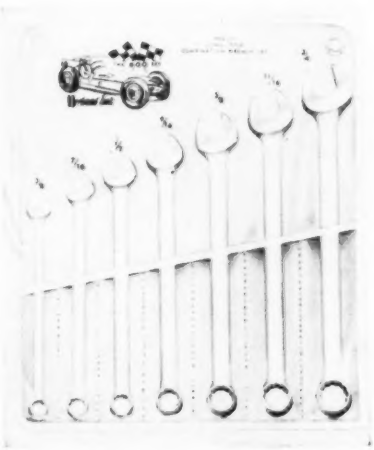
(Circle No. 12 on Reader Service Card)

Gold Plated Wrench Sets

"Gold-plated Cadillacs—why not gold-plated tools?" . . . so Herbrand engineers have come up with a limited number of special sets of their new series of combination wrenches that are plated in 20 karat gold.

Named the "500" set, it commemorates the 10th straight year that Herbrand Tools, the Bingham-Herbrand Corp., has been the official and exclusive supplier to the Indianapolis 500 mile classic. The 7 perfectly matched and proportioned wrenches are packaged in a white coated vinyl roll with gold piping. A picture of this year's winning car and driver appears on the roll . . . a real collector's item.

These wrenches, also available in standard 6 and 12 point sets, were designed with the cooperation of the chief mechanics at the "500." Notable features are: the "Hex-Fit" open ends



for sure-fit grip on the hex nut or bolt; box ends forged from the center line rather than bent after forging; extra long shafts for added leverage and balance. Standard wrenches, hand-polished to a permanent gleaming finish come with end sizes of ⅜″, 7/16″, ½″, 9/16″, ⅝″, 11/16″ and ¾″.

(Circle No. 13 on Reader Service Card)

Collapse-Proof Radiator Hose

With a tempered steel spring incorporated through the length of its tough Neoprene body, this radiator hose is said to be capable of being installed in difficult positions without danger of collapsing and consequently without hindering the flow through the hose.

According to the manufacturer, Wisconsin Rubber Products Co., Inc.,

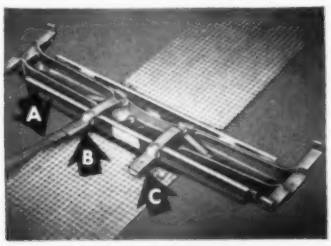
the hose is fully tested to exceed S.A.E. and A.S.T.M. specifications; is resistant to anti-freeze, petroleum bases and rust inhibitors; and will not soften, swell or clog.

Hose lengths are immediately available in 5″ to 60″ lengths in diameters to suit the various makes of cars, trucks, tractors and motors, ready for installation without cutting. No special tools are needed, nor are special clamps required.

(Circle No. 14 on Reader Service Card)

Adapter for Twin-Post Lifts

Weaver Mfg. Co. announces a new front saddle adapter spotting device to further increase the productive use of any model Weaver Twin Post Lift. The new front saddle adapter device



(illustrated), which is painted yellow, is said to make spotting a quick and easy job.

Adapters are designed so that the mechanic has no difficulty in correctly spotting saddle under the proper lifting points. Operator simply inserts shift lever (A) into left (B) or right (C) socket to adjust corresponding adapter in or out. A rear saddle spotting device is also available.

(Circle No. 15 on Reader Service Card)

Chests for Precision Tools

A line of professional quality tool chests, with Starrett toolmaker design and built to their specifications, has been announced by The L. S. Starrett Co. Available in rigidly reinforced steel or hand rubbed Honduras mahogany, the chests are available without tools or with three different assortments of Starrett tools selected to

best fill the basic needs of mechanics ranging from students, apprentices and home workshop craftsmen, to professional machinists and tool and die makers.

The metal chest (No. 200M) is constructed of rigidly reinforced steel with durable maroon wrinkled finish and contrasting black drawer pulls. It measures 20″ x 8½″ x 13¾″ with a 19½″ x 7¾″ x 3¼″ top compartment and weighs 28 pounds. Seven drawers have easy-action slides with positive no-fall-out stops plus spring clips to permit easy removal when desired. Drawers and top compartment are lined with red felt to protect fine tools. Front panel interlocks with top for complete locking and slides under bottom drawer when open.

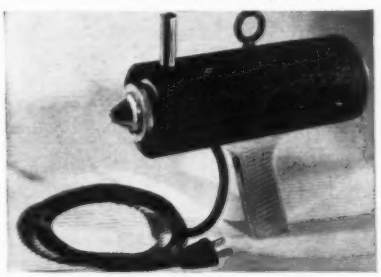
The wood chest (No. 200W) is made of selected grain Honduras mahogany with hand rubbed cabinet finish. It measures 20″ x 9½″ x 13″ with a 19″ x 8¼″ x 2⅜″ top compartment and weighs 19 pounds. Nine drawers are furnished in an array of sizes to accommodate large and small tools. Drawers and top compartment are lined with red felt. Drawers have positive stops plus spring clips for easy removal. Front panel interlocks with top and slides under bottom drawer when not in use.

(Circle No. 16 on Reader Service Card)

Lead Spraying Gun

A lead spraying gun that is said to lead in auto bodies faster, more smoothly and easier than old-fashioned torch leading techniques, is being placed on the market by the Leadit Mfg. Co.

Known as the Leadit Gun, it uses no



flame, and therefore will not distort or buckle the metal, thus enabling an apprentice to actually do expert leading.

Other advantages claimed of the new Leadit Gun are that it works close to glass without heat damage, does not disturb under-coating or sound deadening materials and uses electricity for power.

Two models are presently on the market; Model Four, using one-fourth inch lead bars and Model Five, using three-eights inch lead bars.

(Circle No. 17 on Reader Service Card)

Plastic Body Paste

An entirely new type of plastic paste for autobody repair, reconditioning, customizing and reinforcement which sets in 4 to 20 minutes, is announced by the Baird Dynamic Corp.

Known as Fillerite, this plastic paste uses a powder-type catalyst that is said to let the user speed up or slow down curing time by merely adding more or less of the powder. Since curing action will not start until the powder catalyst is added, Fillerite will not harden in the can, and there is no waste.

According to the manufacturer, the product forms a positive, permanent bond with steel or other materials and cannot be loosened by the roughest roads; is not affected by climate, gas, oil or most solvents, and won't shrink, crack or rot. It is further stated that it can easily be finished to a mirror-smooth surface and feather-edged without showing the repair, and the finished surface refinished without need of special filler or primer.

(Circle No. 18 on Reader Service Card)

Brake Cylinder Cup Expanders

Brake cylinder cup expanders available from Brake Parts Specialty are

so designed and engineered that there are no holes around the edge of the expander for the rubber to press into and become stuck—all surface contact is smooth. Channels feed brake fluid to the edge of the expander, the outside diameter of which is 25 thousandths smaller than the bore of the cylinder, with angle of degree engineered to fit perfectly every regular cup on the market. To prevent corrosion, the expanders are made of solid brass.

(Circle No. 19 on Reader Service Card)

Silicone Spray

4X Silicone Spray, recently announced by Dow Corning Corp. as a companion product to the company's all-silicone 4X Compound, is designed

to provide a faster and more convenient method of lubricating rubber parts to prevent squeaks.

Both products are said to prevent weather stripping from freezing in place in cold weather, make ignition systems sure-starting in damp weather, are effective "anti-seize" coatings for wheel lug nuts, and reduce the white corrosion that forms on battery terminals and cases.

(Circle No. 20 on Reader Service Card)

These are new *manufacturers' products*

Hydraulic Valve Lifter Puller

A new hydraulic valve lifter puller set, for removing hydraulic valve lifters quickly and easily from straight and V-8 automobile engine blocks, has

been introduced by the Owatonna Tool Co.

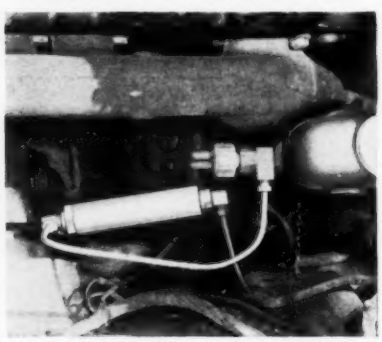
After removal of the lifter spring clip, the jaws of the tool are fitted into the spring clip groove of the lifter. As pressure is applied by the ratchet wrench the jaws of the tool expand and grip the lifter tightly, allowing it to be withdrawn easily.

Plated for protection against corrosion, the tool is made from alloy steel and is heat-treated for maximum strength and durability.

(Circle No. 21 on Reader Service Card)

"No-Vak" Brake Control

Superweld Corp. is offering a "No-Vac" Brake Control which is designed to double the braking action of present braking equipment on passenger cars and light trucks, and greatly increases braking efficiency with smooth, con-



trolled stops—particularly at high speeds.

Easily installed in the brake system between the master cylinder and wheels, the device is said to equalize pressure on all brakes simultaneously and to operate up to pressures of 2,000 p.s.i. When subjected to excess pressures, or in case of any malfunctioning, back pressure unseats a ball check which allows brake fluid from the master cylinder to bypass the "No-Vak" unit and flow directly to the wheels.

Simple to install with ordinary hand tools, the unit comes in handy kit form with easy-to-understand instructions.

(Circle No. 22 on Reader Service Card)

Low Cost Distributor Tester

A new low-cost A.C. operated distributor tester with a speed range to 8,000 r.p.m. for testing distributors on all passenger cars, sport cars, foreign cars, trucks and tractors is now available from Allen Electric and Equipment Co.

The new unit (Model 31-02) can be used for testing 6, 12, 24 or 32 volt distributors (with either single or double contacts) for centrifugal advance, vacuum advance, cam angle, variations in cam lobe, point synchronization, breaker point operation,

shorts and grounds, breaker arm spring tension and excessive wear in cam, shaft, bushing, plate and housing.

The variable speed drive operates in both forward and reverse rotation; distributor chuck has three jaws for automatic shaft alignment and is ball bearing mounted for vibration-free operation. A bright arrow-shaped light within the graduated protractor ring is said to pinpoint the distributor firing pattern with absolute accuracy.

(Circle No. 23 on Reader Service Card)

"Eveready" Suburban Headlamp

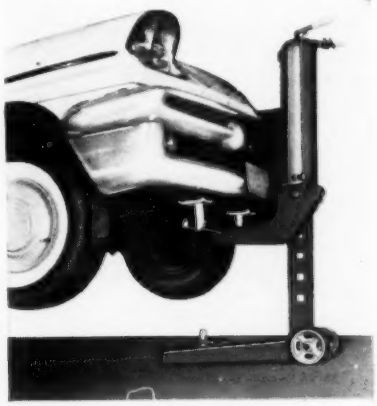
To provide safer seeing when facing oncoming cars, motorists need much more light farther down the right side of the road than is now available from the lower beams of any car with two headlamps. To provide this needed additional light, National Carbon Company, Division of Union Carbide Corp., announces a new, improved "Suburban" headlamp featuring a "built-in spotlight", designed specifically for cars which **do not** have the four-headlamp system.

The new headlamp, interchangeable with all lamps used in two-headlamp systems, will be available in both the 6- and 12-volt sizes.

(Circle No. 24 on Reader Service Card)

One End Air Lift

A new 1½ ton air operated one-end lift, designed to lift all cars to a height of 31" quickly, safely and without damage, is announced by the Walker Mfg. Co. An extra deep 14½" forward



reach clears all bumpers and chrome and allows saddles to reach under and firmly grip the bumper brackets or lifting pads on even the longest cars. Saddles adjust from 16" to 57". Convenient controls are grouped within fingertip reach, and twin safety locks provide positive protection from accidental lowering.

A "Hi-Lift" adaptor, available as an accessory, converts the No. 95 into a jack for use under a lift. The adaptor provides a lifting range from 52" to 75" for easy removal of shocks and springs.

(Circle No. 25 on Reader Service Card)

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11-58

November, 1958—Void after February 28, 1959

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AUTOMOTIVE SERVICE DIGEST is specifically edited for the service specialists of the automotive industry . . . the men who keep automobiles on the road, performing at their best. From front cover through the "Smiles" page, all articles and departments are devoted to subjects and services that will help the man in the shop to do a better job, more profitably.

"TECH KNOW-HOW" FEATURES

●ONLY ASD provides the automotive service field with timely, authoritative, detailed articles of this type. Prepared by men who have the actual experience, as well as the education to "live with" the increasingly specialized service needs of the modern automobile, these features go deeply into the methods and mechanical parts involved. Most "Tech Know-How" write-ups are step-by-step "how-to" descriptions of the latest procedures in a key servicing operation.

"BUSINESS KNOW-HOW" FEATURES

● Covering the "dollar sign" side of our readers' information needs, ASD "Business Know-How" articles present management subjects from the specific automotive service shop viewpoint. They are written for owners and supervisory personnel, by authors of recognized business-management ability; and are based on the actual day-to-day problems of a going automotive service establishment.

AUTOMOTIVE SERVICE EDUCATION

● Toward the solution of one of the most acute needs of our industry, AUTOMOTIVE SERVICE DIGEST carries a continuing series of reviews on how and where the skilled technicians of tomorrow are being trained. Going deeply "into cases," the Service Education series answers the questions of prospective student and management alike.

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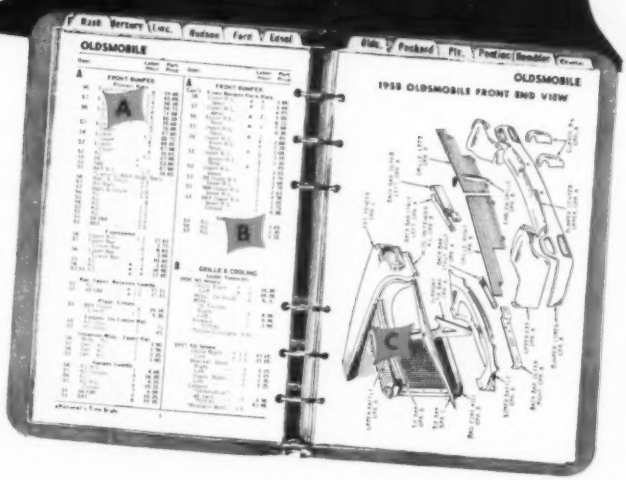
C ILLUSTRATIONS. For quick identification—fast and accurate body shop estimating and billing. This section shows exploded views of front and rear suspensions, grilles, power steering—front sheet metal including sub-assemblies and bumper—body diagrams, indexed by make.

*Where no factory flat rate exists, labor hours are based on National's Time Study.



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These are new *manufacturers' products*

Transmission Jack Adapter

A Truck Cradle Adapter for use with its No. 700 Hydraulic Transmission Jack, is announced by the Edmund J. Wudel Mfg. Co. It is so de-

signed that it will handle the four and five speed truck transmissions in the Chevrolet, Ford, Dodge and others. It tilts the transmission forward to 80°, backwards 20° and sideways 22°. The easy pumping handle rotates a full 360° into any desired position. Free rolling swivel casters allow smooth, easy travel of the loaded jack over any floor.

(Circle No. 26 on Reader Service Card)

Clearsite Battery Gauge

To overcome the headache of unscrewing six battery vent caps to check the six cells for proper water level in the battery—particularly at night or in inclement weather—the

Celluplastic Corp., after two years of field testing, is now offering a trouble-free plastic vent cap for 12-volt lead acid storage batteries which tell at a glance which battery cell needs water. The signalling device is a brightly colored float built into the clear plastic dome of the cap—when the signal is up the cell is full; when down, the cell needs water.

The gauges are all plastic, so there is no rust or corrosion, and they are said to work under any climatic condition to which a battery is normally subjected.

The vent caps are quickly and easily installed—just remove the standard cap and screw the Clearsite Gauge in place. No adjustments to the float or cap are required, and the only maintenance is cleaning, when necessary, with any liquid detergent.

(Circle No. 27 on Reader Service Card)

Generator-Regulator Tester

This new Sun generator-regulator tester (model GRT-100), is designed to provide complete facilities for testing all popular 6- and 12-volt passenger car and truck generators and

regulators, including double contact types.

The tester's heavy-duty 230-volt, 60 cycle, 1 phase constant speed motor and efficient variable speed drive provides full power to generator at all test speeds. Large, easy-to-read meters and unique control panel circuitry makes generator and regulator testing simple and speedy. Sturdy generator mount with chain vise is fully adjustable and regulator mount is cushioned on rubber.

(Circle No. 28 on Reader Service Card)

Cooling System Chemicals

A trio of Flare Cooling System Chemicals is being offered by The Bell Co., Inc., for handling complete cooling system service. First-step

Radiator Flush is said to remove rust, scale and grease from the cooling system in one easy operation without neutralizing. Second-step Water Pump Lubricant and Rust Inhibitor neutralizes acid and prevents rust formation. Its built-in lubricant is said to protect bearings and seals in the water pump, and eliminate squeaks. Third-step Liquid Stop Leak needs no predrain, according to the manufacturer, mixes perfectly with alcohol or glycol anti-freeze types, and is further reported to repair and prevent future leaks in radiators and exterior walls of engines.

All products are said to be harmless to rubber and metal parts and mix perfectly with hard or soft water.

(Circle No. 29 on Reader Service Card)

Fisheye Preventer

A new "fisheye" preventer that can be added to automotive enamels, lacquers and acrylic finishes to prevent fisheyes due to silicone contamination is now being offered by the Ditzler Color Division of Pittsburgh Plate Glass Co. The new product,

known as Ditzler Fisheye Preventer, neutralizes the silicone, preventing cratering or fisheyeing of the finish, thus providing a smooth paint film. In addition to preventing fisheye, the new product is also said to improve gloss, flow, mar resistance and water-spot resistance.

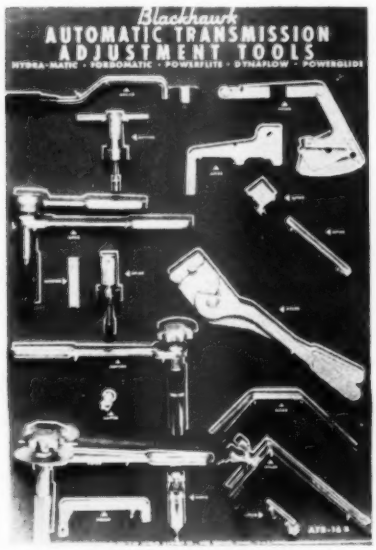
The product is available in 2 oz. and 8 oz. containers with a plastic dispenser that releases the exact amount required for one quart of paint.

(Circle No. 30 on Reader Service Card)

Say You Saw It In
Automotive Service Digest

Transmission Adjusting Tools

Now being offered by The New Britain Tool Co. on a convenient tool board are all the Blackhawk tools that make band and throttle linkage ad-



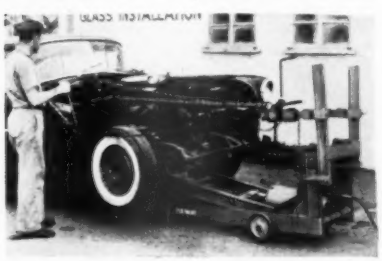
justments quick and easy on all automatic transmissions. Complete, well-illustrated "How-To-Do-It" service instructions come with every tool.

In addition to this new tool board, there are two other boards available; one featuring only band adjusting tools, and the other only throttle linkage adjustment tools.

(Circle No. 31 on Reader Service Card)

Lee Body Man

The new Lee Body Man, recently announced by the Automotive Equipment Mfg. Co., combines the versatility of the air-operated Lee End Lift —raising the car to a convenient working height—as well as providing a solid anchor to pull the metal of



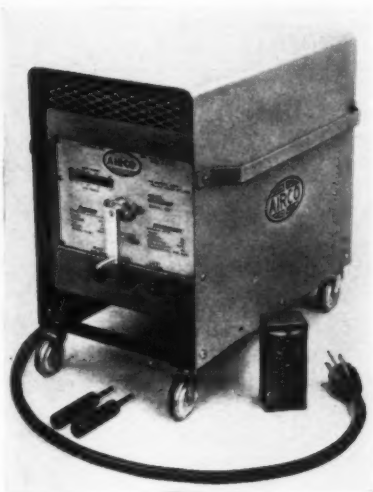
damaged bodies and fenders back into shape from the same direction of the accident impact.

A front end stabilizer provides a solid, immovable base, whether the repair work is to be performed in the front, back or from the side. The repairman can perform all repair work from a comfortable standing position on the rigid, safe, positive locking air-operated end lift. No matter what the job—floor panels, fenders, cowl, fire wall or body, the Lee Body Man is said to do all the heavy work in a matter of minutes.

(Circle No. 32 on Reader Service Card)

Low-Cost Welding Machine

A new low-cost, 180-ampere, portable AC transformer welding machine is announced by Air Reduction Co., Inc. Known as the Airco MSM Busybee, the welder uses glass insulated copper magnet wire in both primary and secondary coils and, as an extra precaution, the coils have been dipped in insulating varnish and baked, to



provide maximum safety and long life. One of the principal features of the machine is its continuous current control within each range which is accomplished by operating the crank on the front panel.

The unit meets all requirements of the REA (Rural Electrification Administration) with a rated input of 37 amperes at 230 volts.

(Circle No. 33 on Reader Service Card)

Heavy-Duty Brake Fluid

A new heavy-duty brake fluid, created to meet the demands of a dependable economy fluid with better than minimum performance characteristics, has been introduced by the Automotive Products Department, Chemicals Div., Olin Mathieson Chemical Corp.

An addition to Olin Mathieson's regular Puritan line of brake fluids, this new heavy-duty fluid is rated to meet or exceed SAE specification 70-R-1, which requires flow at minus 60°F. and a boiling point not less than 300°F.

According to the manufacturer, the new brake fluid is non-corrosive, can be mixed with existing brake fluids made with castor oil or synthetic bases, and fulfills requirements of all states having brake fluid legislation.

Continuing as the premium quality product in the Puritan brake fluid line is Super 60 which meets and exceeds both SAE specification 79-R-1 and the new 70-R-3 which calls for a minimum boiling point of 375°F.

(Circle No. 34 on Reader Service Card)

Bipod Jack

Vulcan Manufacturing Co. announces a new Bipod Jack which features a strong, swinging hook that reaches way under the bumpers of all cars.

Fabricated from high quality channel steel, finished with rust resisting lacquer, the new jack has a smooth, easily operated ball bearing action, and folds compactly, for storage in trunk. It lifts from a low hook position of 3" to 28½" with a rated capacity of 2500 lbs.

(Circle No. 35 on Reader Service Card)

Battery Supercharger

In addition to handling standard 6- and 12-volt car, bus and truck batteries, the new Model 588 Supercharger being offered by Fox Products Co., can be used for 8-, 16-, and 24-volt batteries.

The charger's output is 100 amps

into 6-volt batteries. The super silicon rectifier carries a five-year guarantee; pushbutton and lever switch permit 12 different charging rates. Control is by a 6-hour electric timer, coded for proper charging time, and automatic circuit breakers assure full protection.

(Circle No. 36 on Reader Service Card)

These are new *manufacturers' products*

Guide Lamp Has New Headlamp

Guide Lamp Division of General Motors announces an improved 7" sealed beam headlamp that is said to produce "more light, aimed right" for automobiles that do not have the four-lamp headlighting system. The new lamp carries the trade name "Guide T-3 Powerbeam 50 Headlamp," and may be identified by the numerals "50" impressed in the lens face.

According to Byron L. Stewart, Guide Lamp general manager, "The increased seeing distance provided by the new lamps is of tremendous importance to every driver whose car has them as well as to drivers of oncoming vehicles. In the lower beam, more light is placed in the area along the right hand side of the road and objects are more clearly defined through the improved visibility."

A car equipped with the new lamps is given 100 watts of power on the lower beam, an increase of 20 watts over the older seven-inch lamps. The new lamp, produced in both 6- and 12-volt sizes, is interchangeable with all headlamps on cars that have the two-lamp headlighting system.

(Circle No. 37 on Reader Service Card)

Spark Plug Merchandiser

To promote and stimulate sales of Robert Bosch spark plugs, the company announces an eye-catching, red and yellow, unbreakable plastic cabinet designed to hold 80 spark plugs.

A transparent cover, which slides up for easy removal of plugs, insures at the same time an effective display of the merchandise. Spark plug boxes can also be removed from the back of the display.

Two cabinets or more can be grouped together to form one unit on counter, shelf or wall.

(Circle No. 38 on Reader Service Card)

Mufflers for Foreign Cars

International Parts Corp. is now offering a complete line of replacement mufflers for 20 of the most widely used European cars, including the Volkswagen. These mufflers are being manufactured to factory specifications and offer the additional features of continuous electrically-welded seams and silikote coating for better performance and longer duty.

The new line of foreign car mufflers will be distributed through the regular International Parts distributors, and in all cases the prices correspond

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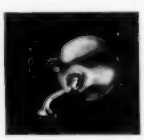

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Right from the start . . . Right for replacement!

exactly to the list prices set by the car manufacturer.

(Circle No. 39 on Reader Service Card)

Magnetic Spark Plug Socket

A magnetic spark plug socket designed for easier removal and installation of spark plugs is announced by the Champion Spark Plug Co. Known as the *Plug-Mate*, it is adaptable to any standard $\frac{3}{8}$" drive wrenches or extensions now in use.

The deep-well, thin walled 13/16"

socket has a built-in "Alnico" magnet to secure the spark plug by the shell. This permits the insulator to be free of metallic contact with the socket and thus lessen the chance of breakage during installation.

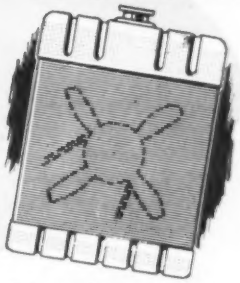
The chrome-plated socket is designed as a companion to the Champion Plug-Master flex-handle ratchet wrench, the combination of which permits easier and faster removal of spark plugs in all popular engines without unnecessary removal of generators, power steering units and other parts which often hide the plugs.

(Circle No. 40 on Reader Service Card)

"You remember the dent you put in the fender, dear?" I'm leaving the car at the garage to have it fixed."

NO ROOM FOR ERROR

IN SERVICING COOLING SYSTEMS



Today's cooling system must operate at peak efficiency because compression ratios and horsepower have gone up . . . the number of power-driven accessories has gone up . . . engine compartments have become more crowded—while the cooling system capacities have gone down.

To keep cooling systems in top condition for your customers, you have no room for error . . . you need to know:

ENGINE COOLING PRINCIPLES. **How excess heat of compression and combustion is dissipated by the cooling system.**

MALFUNCTION OF COOLING SYSTEMS. **Common causes of cooling system inefficiency; failures through foreign deposits, corrosion and deterioration.**

CLEANING, SEALING AND INHIBITING. **Use of chemical cleaners, stop-leaks and corrosion preventatives for maximum efficiency.**

SERVICING COOLING SYSTEM PARTS. **Checking and replacement of mechanical components together with related items of ignition, lubrication and exhaust.**

TROUBLE SHOOTING THE COOLING SYSTEM. **Tracing and correcting causes of overheating, undercooling and inefficient operation.**

COOLANTS. **The use of water, alcohol, Mehtanol, Ethylene glycol and the reuse of antifreeze.**

These topics are covered thoroughly in the COOLING SYSTEMS Service Master Manual. You can get your FREE copy with a subscription to AUTOMOTIVE SERVICE DIGEST. Use the special offer coupon below.

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Automotive Clinic . . .

(*Continued from page 6*)

the float chamber. If there is no gas in the chamber, it will be necessary to determine what is happening to it. If there is no heat resistant gasket between the carburetor and intake manifold, it might help to put in a gasket at least $\frac{1}{8}$" thick, as possibly the heat from the engine is evaporating the gas.

We note that you say you can start it by pouring gas into the carburetor or hand choking it. If you can start it by hand choking, the Sisson choke must not be working right, and this may be your trouble. Sometimes the thermostatic spring in these units loses its tension and the unit should be replaced, not rebuilt.

Check the dwell (should be 32-36°), and also check the flex line to be sure it is not leaking air.

Water in Differential

I am a fleet operator, and among our equipment are several 1958 Ramblers.

Recently I had the experience of having water in the differential. As a result, bearings, ring gear and pinion gears all rusted and had to be replaced at considerable cost to me. The American Motors zone manager tells me we had the vehicle in deep water over the rear axle, and water seeped in through the vent on the axle housing. Now I have my doubts about water getting in the breather plug.

I have heard from other sources that the differentials on the '58 Nash's have a tendency to form condensation after so many miles, causing the water in the differential and all the rusting. Can you tell me if you have heard of this experience?—*C.S., Indianapolis, Ind.*

Answer: This is the first time we have heard of water getting in the rear end of Ramblers, and off-hand would be inclined to agree with the American Motors service man. Unless the cars giving this trouble are stored in a place with excessive humidity, we do not see how water could get into the differential housing unless the cars were driven through water deep enough to get in the axle housing.

If any of our readers have run into an experience like this, we would appreciate hearing from them.

No Brake Pedal

A '51 Chevrolet 2-ton truck was brought into our shop with no brakes, due to leaking right rear wheel cylinders. We rebuilt the cylinders, bled the system and adjusted the brakes.

The Hydrovac booster was replaced with a rebuilt unit, the master cylinder was also rebuilt and the whole system thoroughly checked for leaks.

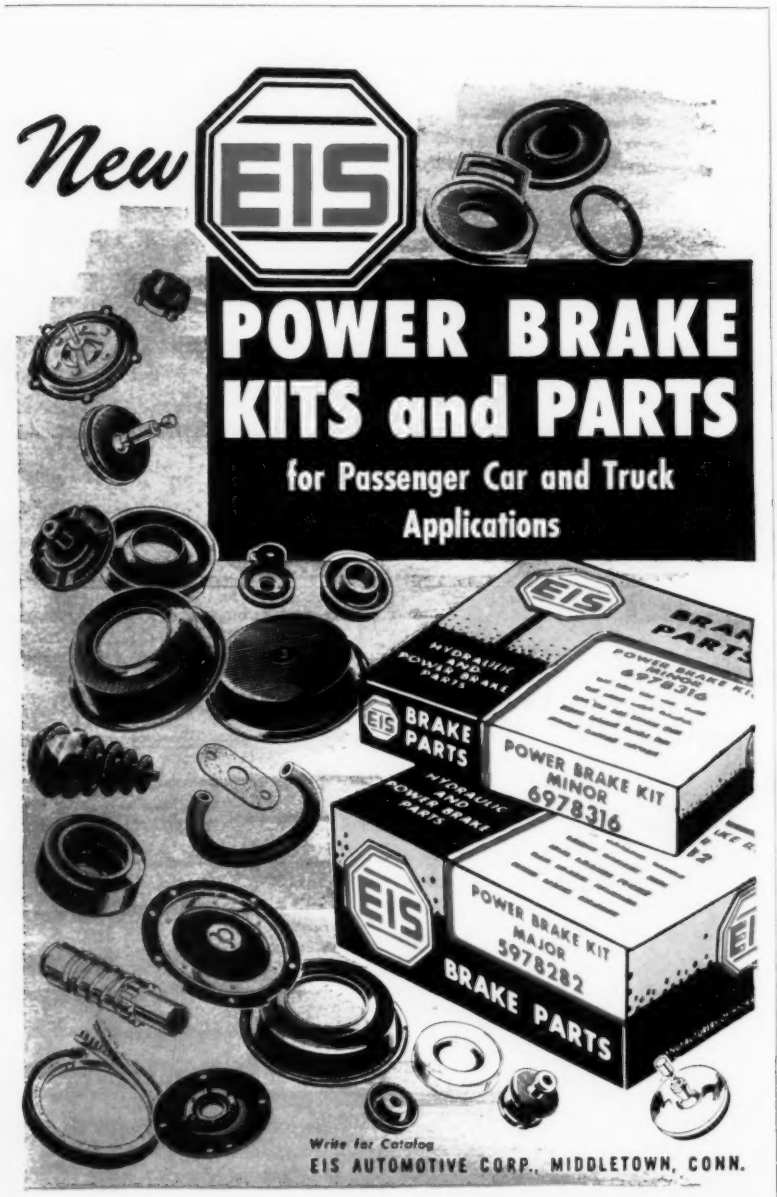
Our problem is to get air out of the system, as we cannot get any pedal on the first stroke; it goes to the floor. The second stroke builds up pressure; the third stroke gives us brakes.

The booster has only one line from the master cylinder. Can it be possible that the valves which should keep the lines preloaded are not functioning in the slave cylinder?—*P.S., Hagerstown, Md.*

Answer: You state that it takes three strokes to build up pressure to give you brakes. The fact that you can get pressure to give you effective brakes indicates that your trouble is not due to air in the system. If you had air, pumping the brake would not give you enough to get effective brake application.

The trouble could be in the master cylinder valve not allowing fluid to fill the cylinder when the brakes are released. However, it seems more likely that the vacuum cylinder is not getting enough vacuum on the first brake pedal movement, so check for air leaks into the vacuum line or cylinder, or for an obstruction in the vacuum passage.

On all brake systems using brake boosters, it must be remembered that from the master or slave cylinder the



brake system is exactly the same as a foot or manual system. The only difference is in the part of the system that supplies the boosting force. Pumping of brakes is usually required when the movement of the brakes requires more fluid than can be supplied with one push of the brake pedal. Since you state that you adjusted the brakes properly, this would not be the cause for pumping. Therefore, carefully check the vacuum portion of the system.

Engine Interchange

I have a 1952 Willys 1-ton pickup in which I would like to install a more powerful engine. Would it be possible to install a Studebaker V-8 engine without using an adapter? I have been told this engine can be installed by just moving the front engine mounts and the clutch housing will fit the present transmission without the use of adapters.—*E.J., Wolf Point, Mont.*

Answer: According to information on hand, the only engine that will interchange with the engine in your Willys pickup to give you more power is the Henry J 6-cylinder or the Willys 6-cylinder. You do not say what engine you now have, so we assume it is the 4-cylinder.

We cannot tell you anything about the chances of the Studebaker V-8 engine fitting, but it does not seem logical. If your source of information about the Studebaker engine is dependable, and it will fit, then that would be your most powerful engine for the Willys; but this should be carefully checked.

It Can Be Done, But . . .

A customer of mine has a 1958 Ford on which he wants me to install an ammeter to work in conjunction with the tell-tail light on the dash.

I first tried wiring the gauge in series with the B terminal of the headlight junction block. All I got was a headlight, brakelight, horn and accessory discharge indication, with engine not running. With engine running, no charge indication. Radio and turn signals won't indicate a discharge, since they go to accessory side of ignition switch block.

Next I tried wiring the ammeter to the terminal of the starter relay where the lead comes from the voltage-regulator. Still got a discharge indication, but no charge indication with engine running.

When wired in series with the lead from the generator, I get the charge rate, but no discharge.

Evidently the electrical system of the '58 Ford incorporates some slight changes over the '56 models, because on the '56 Ford I installed an ammeter in series with the B terminal on the headlight junction block, and everything worked fine.

Your suggestions would be appreciated.—*C.W., Indianapolis, Ind.*

Answer: Hooking an ammeter into the '58 wiring system is not a very satisfactory operation. To do so, the meter would have to be inserted in the wire that leads from the hot terminal of the starter relay and be located between this point and the point where the lead goes to the light and accessory switch. If the ammeter is to be located on the dash, then very heavy wire will have to go to the dash from the place where the main wire to the starter relay is cut. This will introduce an undesirable voltage drop in the system due to the length of the meter leads.

On some cars, the so-called loop circuit is used, and in this case there is no place where an ammeter can be inserted to show both charge and discharge of the battery.

The next best thing is to get a small voltmeter that reads up to 16 volts and connect it to any hot terminal. This will indicate the system voltage at the connection point and can be used to tell whether the battery is being charged, is discharging, or is inoperative.

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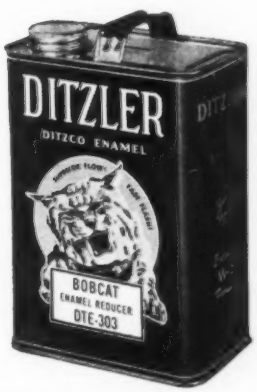

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PNEUMATIC DRILLS . . . Latest Air Speed Tool Co. catalog covers nine types of pneumatic drills, including light weight, high speed and heavy duty models. Along with illustrations and descriptive information, a specification table gives interesting data on each model.
(Circle No. 41 on Reader Service Card)

SHOP PRESSES . . . 16-page Owatonna Tool Co. hydraulic shop press manual fully illustrates presses from the 17½ ton bench size through the 30, 50 and 100 ton units. All presses are designed to be powered by the OTC center-hole hydraulic ram which may be removed for optional use in the shop or on the job site.
(Circle No. 42 on Reader Service Card)

DOOR OPENERS . . . New illustrated bulletin gives latest features of Barcol's electric overhead door operators, now designed to operate standard doors up to 19'2" wide with up to 240 sq. ft. area—an increase of more than 50% over previous door limits. Any number of pushbutton controls are available, as well as radio controls.
(Circle No. 43 on Reader Service Card)

SAFETY EQUIPMENT . . . The R. E. Dietz line of automotive lighting and safety equipment is fully described in new three-color manual. Included are pictures, dimensions and specifications on turn signals, mirrors, stop lights, clearance marker lights, flare kits and extinguishers, searchlights, spotlights and fog lights.
(Circle No. 44 on Readers Service Card)

WELDING SUPPLIES . . . A new 52-page welding supplies and accessories catalog is available from Air Reduction. Illustrated with over one-hundred photographs, this booklet covers Airco's complete line of fluxes and ferrous and non-ferrous rods for gas welding; and accessory items including protective clothing, goggles, electrode holders, sparklighters, cable, hose, weld cleaning tools, cylinder trucks and many other items, for both arc and gas welding.
(Circle No. 45 on Readers Service Card)

HAND TOOLS . . . Eight new time saving tools are listed in the K-D Mfg. Co. Fall Catalog Supplement. Tools described include: A flexible cable distributor adjuster for Delco-Remy, plus a "window" holder; molding clip installer for Chevrolet and Pontiac; brake shoe spring tools for Lockheed and Bendix; petcock drain tool with flexible cable; piston ring expander with adaptors for popular sizes.
(Circle No. 46 on Readers Service Card)

HEATER PARTS . . . 20-page, illustrated catalog features Everhot Products Co. universal heater parts, fittings and other winter goods. Provides comprehensive car application data on all popular American cars produced from 1931 through 1958.
(Circle No. 47 on Reader Service Card)

TUNE-UP CHARTS . . . The A. E. A. announces a new series of 1958 tune-up charts with the latest engineering changes and specifications covering all 1958 models of passenger cars. The charts also include specifications on many of the ignition and carburetor power packages furnished as special equipment on the '58 models. A special feature of the new series is a special chart booklet covering the '58 wiring diagrams at no extra charge.

Price of the new '58 series, including the wiring diagram booklet, is $3.00. Order direct from Automotive Electric Association, 16223 Meyers Road, Dept. ASD., Detroit 35, Mich.

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the new
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battery
TERMINAL CLAMP
and POST CLEANER
makes battery service easier, more efficient
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You may want this information, and most of it comes to you free. Just circle the key number on the Reader Service Card corresponding to the one that appears with the editorial review. Our Reader Service Department will forward your inquiry to the manufacturer or supplier for attention.

EXHAUST SYSTEM PARTS . . . 80-page, illustrated catalog features interchangeable data for Everbend's flexible tailpipes, exhaust pipes and dual exhaust systems for almost any make or model car or truck from 1935 through 1958. Passenger car alphabetical data and truck alphabetical data appear as separate listings, for easier reference.
(Circle No. 48 on Reader Service Card)

RADIATOR CORES . . . A new radiator core identification wall chart is now available which lists in easy-to-read form the model and year of motor vehicle, the original equipment radiator number, core dimensions, the number of tube rows and sizes, the fin count, top and bottom header sizes, and type of radiator construction. A series of silhouette line drawings clarify the identity of the various types of radiator and speed up selection of the right core for replacement and servicing.
(Circle No. 49 on Reader Service Card)

FUEL PRESSURE REGULATORS . . . Milesmaster, Inc. is offering a pamphlet on fuel pressure regulators which answers, in non-technical language, such questions as: Do they really work to save gas, stop stalling, improve performance, etc.? Are they important? Is there any difference in the different types? Why hasn't Detroit put them in new cars? . . . and fifteen other questions concerning their operation.
(Circle No. 50 on Reader Service Card)

TRUCK LUBE GUIDE . . . Chek-Chart's 1958 edition of the Truck Lubrication Guide contains 112 fact-filled pages of factory-approved lubrication information. Covers all popular standard production truck models from 1949 through '58, as well as axle, semi-trailer, and trailer units; specially assembled, heavy-duty, and special purpose trucks; and school buses and motor coaches. Service instruction section of the Guide clearly explains and illustrates the proper service procedure for every item listed on the individual diagram charts.
(Circle No. 51 on Reader Service Card)

WIRE AND CABLE . . . This new automotive wire and cable catalog contains the most complete and current passenger car, truck and tractor data available, as well as the first listing of the more popular sports car and foreign car applications. In addition, the catalog contains many new and improved products to enable jobbers to offer a most complete line of automotive wire and cable from one source.
(Circle No. 52 on Reader Service Card)

BRAKE MANUAL . . . The Barrett Equipment Co. announces the Third Edition of its Brake Service Training System Manual. Included in the manual's 260 pages are 405 illustrations covering all phases of brake service work through fundamentals and principles of operation on each type of brake system . . . power brakes . . . and the use of precision equipment and trouble shooting of brake systems through 1958 model cars.
(Circle No. 53 on Reader Service Card)

Calendar of Automotive Events

1959

Jan. 17-25—Chicago Automobile Show, International Amphitheatre, Chicago, Ill.

Jan. 31-Feb. 4—National Automobile Dealers Assn. Convention and Equipment Exhibition, Conrad-Hilton Hotel, Chicago, Ill.

Feb. 2-5—Automotive Accessories Manufacturers of America Show, Coliseum, New York N. Y.

Feb. 15-17—Motor and Equipment Wholesalers Assn., National Convention, Conrad Hilton Hotel, Chicago, Ill.

Feb. 15-17—Automotive Affiliated Representatives Meetings, Pick-Congress Hotel, Chicago, Ill.

Feb. 18-21—Automotive Service Industries Show, Navy Pier, Chicago, Ill.

Feb. 27-March 8—World Wide Auto Show, Miami Beach Exhibition Hall, Miami Beach, Fla.

March 11—MEWA Western States (PAS) Conference, Fairmont Hotel, San Francisco, Calif.

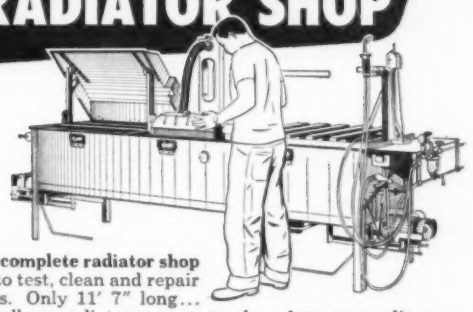
March 12-15—Pacific Automotive Show, New Brooks Hall, San Francisco Civic Auditorium, San Francisco, Calif.

May 3-8—Top Management Institute, Motor and Equipment Wholesalers Assn., Allerton House, University of Illinois, Monticello, Ill.

June 24-27—Independent Garage Owners of America, Inc. (IGOA) National Convention, Albany Hotel, Denver, Colo.

Oct. 28-30—Automotive Parts Rebuilders Assn., 12th Annual Convention, Hotel Roosevelt, New Orleans, La.

NEW! INLAND 1-Piece RADIATOR SHOP



Now—a **complete radiator shop** ...easy to test, clean and repair radiators. Only 11' 7" long... handles all car radiators, many truck and tractor radiators.

FREE FACTORY SCHOOL will train one of your men...and in only a part of his time he will produce nice additional profits. Many adding $8,000-$15,000 a year servicing radiators.

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And Also Crimps
Rajah Terminals to ignition cable without the use of solder or any other tools

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Certain Precautions Must Be Taken When Towing Cars with Air Suspension

• WHEN A CAR equipped with air suspension must be towed, several precautions and instructions must be followed, in addition to the standard towing procedures.

Chevrolet, for example, has issued the following instructions for towing their models equipped with "Level Air" suspension.

Where the air suspension system is functioning and is exhausted of air, run the engine and compressor long enough to fill the system; then close the manual shut-off valve provided in the junction block, raise the car and proceed in normal manner.

Should it be impossible to operate the compressor, the system may be filled from a tow truck equipped with a compressor or storage tank. To do this, remove the cap from the Schrader valve on either the high pressure accumulator or the junction block and apply pressure until system inflates to normal. Close the manual shut-off valve (on junction block) and proceed as in normal towing procedure. However, be certain to open valve when car is no longer being towed.

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Drives it too!
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SCREWDRIVER
2" to 14" blades. 4 bit sizes. Available with shockproof plastic covered tubing. Unconditionally guaranteed.

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WHEN SYSTEM WON'T WORK

Due to the design of the air suspension system, a unit that has been completely exhausted of all air, and due to collision or system malfunction cannot be operated, several difficulties not normally found on standard suspension units, will be present.

Without air pressure in the system, the body and frame will settle down toward the ground until stopped by the suspension snubbers. In this condition the body-frame as an assembly will not have more than 2-4" (approximately) ground clearance. At this height, forward movement of the car would be limited to relatively smooth roads and towing speeds would have to be kept at 10 m.p.h. or below.

However, the above towing conditions are not always present and several precautions must be taken. The following procedures are suggested methods rather than hard-and-fast rules, as each towing operation will vary due to conditions beyond normal control.

FRONT END RAISED

Method No. 1—Attach towing truck lifting chains to appropriate location on frame or cross member. Raise slightly to allow removal of front wheels. Lower chains slightly to give adequate clearance for towing. DO NOT tow for great distances or at speeds over 10-15 m.p.h. Check periodically to see that chains have not slipped out of position or that ground clearance has not lessened due to type of road, shifting loads, etc.

Method No. 2—Make up two rear axle spacer blocks (of suitable hard wood or metal) and of such a construction that they may be securely attached to the axle housing and frame kick-up to prevent them from falling out on rough roads. A possibility would be to drill a hole through the bottom and top and with steel cable and "clinchers" attach to frame and axle housing. Then attach towing chains to front cross member or frame and tow, but at reduced speed.

When using this method, the body-frame assembly will have to be raised sufficiently with suitable jack or hoist to allow installation of spacer blocks.

REAR END RAISED

Using a suitable jack or hoist, raise front of body-frame assembly far enough so that the inner ends of both lower control arms are pointing upward a slight amount. Take a piece of 22" x 6" board (one that will not crack, splinter, break, etc.) and securely attach under the cross member and to the outer portions of the lower control arms. Suitable "C" clamps, chain or steel cable may be used for this attachment. **Note:** A suitable piece of boiler plate channel iron or angle iron may be substituted for the wooden board. However, the attachment must be secure.

WHEN CHANGING YOUR ADDRESS

Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept. Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**

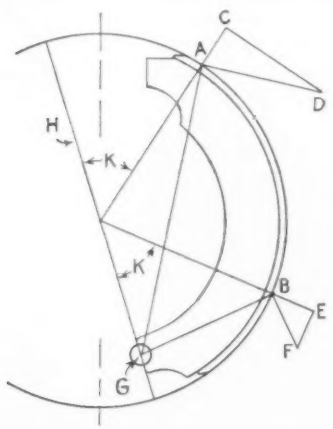
BRUSHING UP ON THOSE

EASY-TO-FORGET THINGS

Refresher course

Angular movement of brake shoe on drum

● A CONVENTIONAL BRAKE SHOE can move only angularly around its fulcrum on the anchor pin, G. Upon brake application, any point on the lining surface moves directionally at right angles to a line connecting it with the fulcrum, and at a velocity which is proportional to its distance from the fulcrum. For example, point A will move in the direction AD, a line representing the direction and magnitude of point A's motion. This can be further resolved into two components, radial motion AC and tangential motion CD.



Point A on brake lining is twice the distance from fulcrum G as point B, yet both approach the brake drum at equal velocities since radial components of velocities, AC and BF, are equal.

Two points on the lining surface approach the drum at the same velocity even though the toe of the brake shoe moves faster than the heel because of being further away from the fulcrum. If both points A and B are at equal angular distances (K) from a diameter H, through the fulcrum G, both A and B approach the drum at the same velocity.

Point A, near the toe is twice the distance from the fulcrum G as point B, near the heel. Thus the motion of point A, represented by AD is twice that of point B, represented by BF. However, the radial components of the motions of both points, AC and BE, are equal. From this it becomes evident that when making lining-to-drum adjustments, the specified clearance at the toe and heel should be the same.

Instrument Corner . . .

(Continued from page 47)

parently slight opens in the other two wires, so the test light would not work and neither would the voltmeter connected up the same way.

Finally the clamps holding the wires had to be removed so they were free and could be traced from end to end. They were then put in their proper places enabling the engine to run as it should.

Is there any easier way to do this job, which could come up at any time?

The difficulty in tracing the wires was due to slight opens in them which would pass the high tension ignition current but not the low tension six volt current. One way to trace the wires would be to insert distributor end of the wire in the coil tower and turn the engine over with the cranking motor. Watch the wire ends for one that has a spark jumping to a spark plug. Following a diagram showing the arrangement of wires in the distributor cap, put the wires in their correct places with the other ends on the corresponding spark plugs.

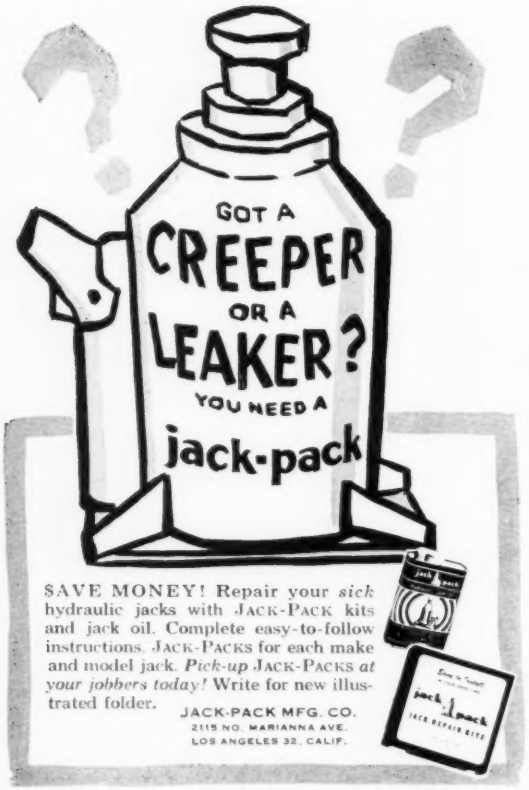
Another way would be to use the coil tester which applies high tension current as a source of testing current.

Problem: A 1957 Plymouth V-8 has a peculiar trouble. It will start and run good for a week or so. Then it starts to kick back and stops. It has been timed correctly and has had new plugs, points and condenser. When it is retimed it runs good for another week or ten days, then the same thing happens again.

What have we missed or what should be done to correct this situation?

During the discussion of this problem, a number of suggestions were made. Recheck for correct timing procedure. Check the vacuum control orifice in the carburetor. See if the dwell is changing or the breaker plate is shifting. The distributor drive gear may not be keyed to the shaft, and slips after the timing is set. The cam pressed onto the distributor shaft may be slipping. The distributor cap locating lug may be broken allowing the cap to shift.

Since the trouble seems to be in the distributor, replacing it would probably be the easiest and most economical way to correct the trouble. All the other components seem to check out all right. If cross firing caused the trouble this would not be affected by correcting the timing which seemed to help for a while.



SAVE MONEY! Repair your *sick* hydraulic jacks with JACK-PACK kits and jack oil. Complete easy-to-follow instructions. JACK-PACKS for each make and model jack. *Pick-up* JACK-PACKS *at your jobbers today!* Write for new illustrated folder.

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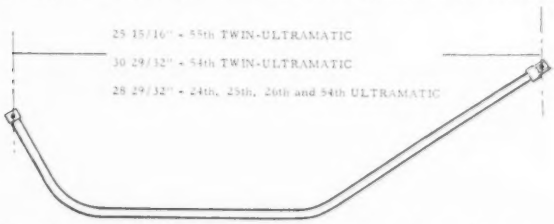
Use Correct Dimension When Checking Ultramatic Throttle Control Rod

Because of the shape of the Ultramatic throttle control rod, it is sometimes difficult to determine whether or not it is bent so as to affect its function to control



throttle pressures, clutch engagements and upshifts.

To be sure the rod is of proper length for the various models, Studebaker-Packard recommends it be checked against the dimensions shown in the accompanying drawing.

Importance of Spark Plug Performance Demonstrated to Mechanics and Students

Last year over 24,000 mechanics and vocational students witnessed demonstrations by seven Champion Spark Plug Co. service engineers throughout the country, which showed the actual effects of operating conditions and engine adjustments on power output and spark plug performance.

Subjects discussed and demonstrated during the programs included coil polarity, effects of detonation, ignition timing, ignition system output, operation temperatures and spark plug heat ranges.

The New

K. O. Lee Valve Guide Reaming Sets

Designed to service late model engines which have valve guides cast as part of the cylinder head. In this new type head, it is the valve which has to be replaced. This is accomplished by reaming out the valve guide for oversize stem valves. Most of the engine and valve manufacturers now offer at least three sizes of oversize valves.

The Lee Reamer Guide provides a true alignment with original guide bore using Lee Self-expanding pilots. The reamer is held rigid with reaming bushing during reaming operation. Simple to operate and extremely accurate.

Special sets available to service Ford, Mercury, Lincoln, Chevrolet, Plymouth, Dodge, DeSoto, Chrysler.

R55 Reseater Power Drive adapts to these valve guide reaming sets.

Clip ad to your letterhead and send for Literature.

K. O. Lee Company, Aberdeen, S. D.

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No Christmas gift is more widespread or important in effect than Christmas Seals which fight tuberculosis. Given by most Americans, they help make possible the greatest gift of all—health, life itself.

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This space contributed to the National Tuberculosis Association and its affiliates by

AUTOMOTIVE SERVICE DIGEST
900 S. Wabash Ave., Chicago 5, Ill.

Small Engines Service Manual

. . . by Technical Service Division (Implement & Tractor Publications, Inc., 1014 Wyandotte, Kansas City 5, Mo.) 246 pages, $4.65.

The scope of the third edition has been broadened by adding three sections: (1) Gas Engine Fundamentals; (2) Troubleshooting and Servicing of Ignition and Carburetor Equipment, and (3) Troubleshooting for Beginners.

Gas Engine Fundamentals, simply and clearly presented, can be used as a teaching guide and for upgrading apprentices and training of non-experienced personnel.

Similarly, Troubleshooting and Servicing of Ignition and Carburetor Equipment furnishes the non-specialist much of the background knowledge required to efficiently service a variety of makes of such equipment.

The third edition contains instructions and specifications for the maintenance and repair of engines used on mowers, small tractors and many other installations. The model designations, general description, maintenance, tear-down and reassembly procedure is given for twenty-four different makes of engines.

The manual is well illustrated, including many exploded views of assemblies. Included is a complete part specification and listing of central parts distributors.

A handy shop data section contains useful tables and formulas and "Requirements for Servicing Small Engines" has suggested shop layouts along with illustrations of necessary equipment and its use.

Check Fan-to-Radiator Clearance

According to a recent Dodge Service Bulletin, if cooling fan or radiator replacement should be necessary on their cars equipped with L350 or L360 engines, it is recommended that the fan-to-radiator clearance be checked.

With fan and radiator fastened in position, the clearance between the fan blades and radiator core should be ½" to 1". To obtain the proper clearance, two fan spacers are available, Part No. 1825931 (13/16" thick); Part No. 1855808 (39/64" thick).

Statement of the Ownership, Management, and Circulation Required by the Act of Congress of August 24, 1912, as Amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation.

Of "AUTOMOTIVE SERVICE DIGEST," published monthly at Chicago, Illinois, for October 1, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Name	Address
Publisher, Oscar H. Baehler	900 So. Wabash Ave.
Editor, Ben M. Ikert	900 So. Wabash Ave.
Managing Editor: George A. Whittington	900 So. Wabash Ave.

Business Manager: None.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Name

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

Oscar H. Baehler,
Publisher

Elizabeth E. Gould,
Notary Public

Sworn to and subscribed before me this 23rd day of September, 1958.
[Seal]

(My commission expires October 1, 1961)

Camber Adjusting Problem?
EASY Solution: Houser No. 720

As front suspension parts wear and the front coil springs "set" negative camber results. On 1955-56-57 Chevrolets, positive camber is increased as shims are removed. When all shims are removed, additional adjustment is impossible.

HOUSER'S NO. 720 CAMBER ADJUSTING BOLT permits moving the lower control arm just 1/8" toward the center of the car. This increases positive camber one full degree and allows regular shims to once again be used for final adjustment.

Installation of Houser's No. 720 is easy — no disassembly, no bending, no new parts required. Takes less than an hour to drill and install bolts on both sides.

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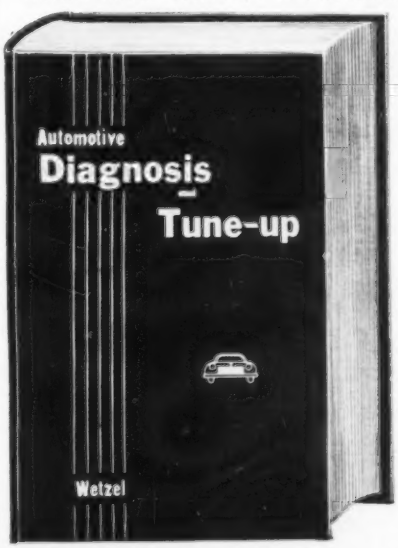

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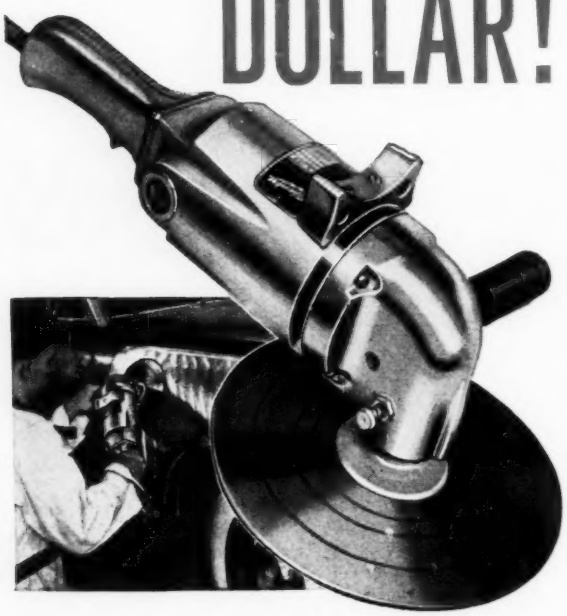

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5324 W. STATE ST. MILWAUKEE 8, WIS.

Suspension System . . . *(Continued from page 33)*

hammer. Back up the knuckle with another hammer to avoid distortion and to assist in jarring loose the ball point stud.

7. Using the same procedure, remove the upper ball joint. With both joints removed the brake drum assembly can be hung on the frame rail away from the suspension arm assemblies.
8. Remove the bolts attaching the lower control arm shaft to the crossmember.
9. Unscrew the spring compressor, and remove the spring and lower control arm from the vehicle.

Inspection: Inspect the upper ball joint as described earlier. If it is excessively loose, the upper control arm can be removed from the frame bracket by removing the shaft retaining bolts. Be sure to note number and location of shims between shaft and bracket. If both ball joints are to be replaced, chisel off the retaining rivets, and separate the joint assemblies from the control arms.

Install the replacement ball joints in the control arms using the special attaching bolts supplied as part of the replacement package. Torque the nuts to specifications (usually 10 to 12 ft. lbs.). Time can be saved by lubricating the ball joints *before* the control arms are assembled to the vehicle. This eliminates the need for hoisting the entire car to lubricate the ball joints.

With the replacement ball joints properly installed and lubricated, install the control arms, the drum assembly, and the tire and wheel by reversing the procedure of removal.

ADJUSTMENTS

As most manufacturers recommend, it's a good policy to check the front end alignment after replacing any parts of a ball joint system. Caster and camber adjustments of ball joint suspension systems are controlled by shims placed between the upper control arm inner support shaft and the support bracket attached to the frame side rail. The shims are "spade shape" to fit over the mounting bolts used to attach the shaft. There are two locations at which shims are placed—at the front bolt, and at the rear bolt.

The addition of shims at the front bolt, or removal of shims at the rear bolt, will decrease positive caster. One shim (1/32") will change caster ¼ degree. Adding shims at both front and rear bolts will decrease positive camber. One shim (1/32") will move camber ⅛ degree. When proper number of shims have been located to provide correct front end alignment, tighten the mounting bolts securely.

The use of ball joints for automotive front suspension systems has just about outmoded the king pin and bushings type suspension. It's a much superior system in many ways. Plus, of course, it's easier and cheaper to manufacture. This means that ball joint know-how and experience is necessary if a mechanic hopes to make a living servicing the front end systems of modern passenger cars.

Fortunately, ball joint suspension is an uncomplicated, clean mechanism which doesn't require much in the way of technical trouble-shooting or service. A good inspection technique, and an efficient replacement procedure will put most mechanics in a position to earn a fair amount of money servicing ball joint systems.

Next month: "Torsion Bar Suspension."

Say You Saw It In Automotive Service Digest

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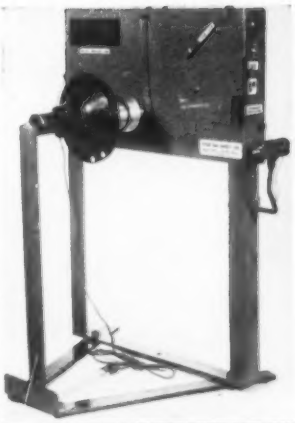

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Firms represented in this issue are indicated by page number. Advertisers in previous issues are indicated by the asterisk.

HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

A man was justifiably proud of his lawn until one year a heavy crop of dandelions appeared. He tried everything imaginable in an effort to get rid of them, but without much success. Finally in desperation he wrote to an agricultural college, listing the remedies he had tried, and concluded with the appeal, "What shall I do now?"

Several weeks later he received this reply: "We suggest that you learn to love them."

★ ★ ★

The man with laryngitis whispered over the phone, "Is the doctor in?"

"No," the nurse whispered back, "come on up."

★ ★ ★

The undertaker noticed a wrinkled, little old lady shuffling away from a funeral service at his parlor, and asked how old she was.

"One hundred and one," proudly cackled the old lady.

"Well, well," said the undertaker, suavely. "Hardly worth going home, is it?"

★ ★ ★

The elevator was jammed when a girl said fiercely: "Take your hands off me, you louse! No, not you! YOU!"

★ ★ ★

A modern mother and her young son were shopping in a supermarket. The child, trying to help, picked up a package and brought it to her.

"No, no, honey," protested the mother, "go put it back. You have to cook that."

★ ★ ★

SO EASY TO ENJOY

My mistakes serve a purpose,
I have little doubt;
They give others pleasure
In pointing them out.
—Eugenia Emrick.

A delegation from one of the town's political groups waited patiently at the airport for the great man who was to address their meeting. He didn't show up and they went dejectedly back to town—only to find that he had arrived by train.

After completing his address, the great man was approached by the chairman of the club's welcoming committee.

"Sir," said the chairman, "we're powerful sorry we couldn't escort you into our fair city, but we sure will take great pleasure in escorting you out of it."

★ ★ ★

Boy in hospital ward: "Are you medical or surgical?"

Second boy: "I don't know what you mean."

First Boy: "Were you sick when you came, or did they make you sick after you got here?"

"What's the charge for a major tune-up with a long time guarantee?"

A fugitive scientist from a horror picture dreamed up a serum that brought inanimate objects to life. He tried it out on the statue of a great general. Sure enough, the statue gave a quiver and the general, creaking a bit in the joints, climbed down from the pedestal. The scientist was overjoyed. "I have given you life," he exulted. "Now tell me, what is the first thing you're going to do with it?"

"That's easy," rasped the General, ripping a gun from his holster. "I'm going to shoot about two million pigeons."

★ ★ ★

"Didn't I tell you to notice when the soup boiled over?"
"I did. It was 10:30."

★ ★ ★

"How did George go through his rich uncle's inheritance so fast?"

"Well, he spent a good bit of it on wine, women and song. The rest he squandered."

★ ★ ★

Employee: "Can I have the afternoon off to go shopping with my wife?"
Employer: "No."
Employee: "Thank you, sir."

★ ★ ★

Shop Foreman: Having trouble tuning that imported car?

Mechanic: The way it's acting I bet it was deported.

★ ★ ★

Old Lady: "The weather here in Florida is so wonderful—how do you tell summer from winter?"

Hotel Clerk: "In winter we get Cadillacs, Lincolns and stuffed shirts. In summer we get Chevrolets, Fords, and stuffed shorts."

★ ★ ★

A castaway from a wrecked ship was captured by cannibals. Each day his arm was cut by a dagger and the natives would drink his blood. Finally one day he called the king. "You can kill me and eat me if you want to," he said, "but I'm tired of being stuck for the drinks."

★ ★ ★

An evangelist recently announced that there are 726 different sins. He received thousands of requests for the list from people who thought they were missing something.

★ ★ ★

Three turtles decided to have a cup of coffee. Just as they went into the cafe it started to rain, so the biggest turtle said to the smallest one, "Go home and get the umbrella."

"I will if you don't drink my coffee," the little one said. The other two promised they wouldn't.

Two years later the big turtle said to the middle-sized turtle, "Well, I guess he isn't coming back, so we might as well drink his coffee."

Just then a little voice called from outside the door, "If you do, I won't go."

***CHROME C-9 OIL RINGS with Circumferential Expansion Action**

A new high in conformability. With an average of 60 outward thrusts, C-9 adapts easily to cylinder variations and variable operating conditions, in both stop and go and high speed operations.

***CHROME SPIRO-SEAL OIL RINGS with Circumferential Expansion Action**

The RAMCO Spiro-Seal Segment works like a watch spring: gentle outward pressure lets it adjust to any taper or wear. Provides equalized pressure against cylinder wall for positive oil control.

SMART MOTORISTS WANT RAMCO RE-POWERING

for that new car power...

Of course, they don't *know* they want RAMCO rings—but *you* do.

Smart engine men know how to be DOUBLE SURE to put finest get-up-and-go (and customer satisfaction!)—into every ring job.

They do it with RAMCO piston ring sets. So can you.

You'll be DOUBLE SURE of success because only RAMCO makes TWO *circumferential expansion action** oil rings available to you—the C-9 or the Spiro-Seal. Each is chrome railed. Each comes in the 10-Up Set *specifically intended* for the engine you're working on—be it old or new.

That's why you're DOUBLE SURE of customer satisfaction—why smart motorists will come to *you.*

Be DOUBLE SURE! Call your RAMCO Jobber today.

DOUBLE SURE RAMCO 10 up SETS

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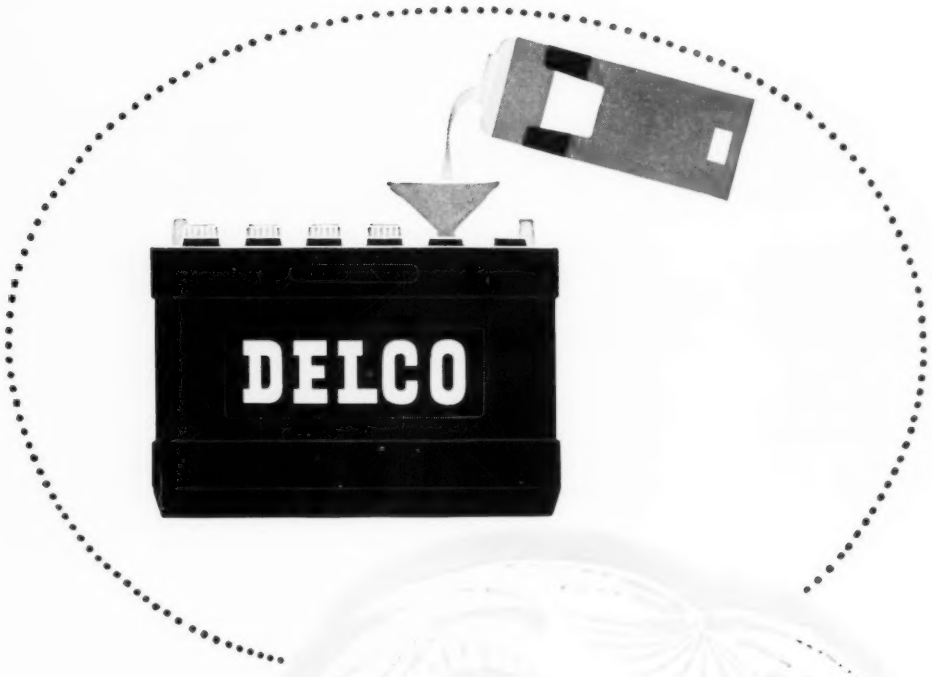

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Quality built by Delco-Remy distributed nationally through

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